APPENDICES

ENERGY ENGINEERING ANALYSIS PROGRAM

LIMITED ENERGY STUDY

FORT HUNTER-LIGGETT, CALIFORNIA
1993

VOLUME II

PREPARED FOR

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

19971016 255

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APPENDIX B

Baseline Energy Use Calculations

APPENDIX B

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APPENDIX B

BASELINE ENERGY USE CALCULATIONS

B.1 Methodology

Energy consumption in selected existing buildings is determined for various categories of end-use separately for fuel oil, propane and for electric power consumption. Categories of energy end-use and tables where results are summarized include:

- Heating, Table B-2
- Cooling, Table B-2
- Ventilation, Table B-2
- Domestic Hot Water, Table B-2
- Lighting, Table B-3
- Process, Table B-3

Existing conditions for baseline energy use are determined based on field data using computer simulations, standard engineering calculations and empirical information developed from similar investigations. The results are tabulated and compared to available consumption records. Results of building energy use calculations are summarized on Table B-1.

Procedures used to determine energy consumption for each of the above categories are addressed below.

B.2 Space Heating, Cooling, and Ventilation Energy Use

Heating, cooling, auxiliary equipment, and ventilation energy uses are determined using the computer simulation program: Trane Air Conditioning Economics (TRACE) 600.

The TRACE 600 program is used on buildings as identified on Table B-4. This program calculates hour-by-hour loads for each zone.

Results of building simulations are shown on Table B-2.

Manual calculations are used to determine energy use for the remaining buildings evaluated. HVAC energy use is calculated based on results of TRACE 600 runs on similar buildings, fuel and electric power consumption records and on manual calculations of block loads considering the weather data developed in Appendix C.

Data for simulation programs and manual calculations are taken from the available information contained in:

- Building survey notes (see Appendix F).
- Available building plans, copies of which were made during site visits.
- Interviews with Directorate of Engineering and Housing personnel.
- Building information schedules and fuel use records and efficiency measurements.

Although Tables B-1 and B-2 show only the baseline HVAC energy use for each building, buildings are resimulated and evaluated with changed conditions for analyses of various energy conservation opportunities (ECO's). Refer to Appendix D for ECO calculations.

B.2.1 Heating Energy Use

Heating energy used to serve heating loads is recorded as fuel oil, propane and/or as electricity use. These entries correspond to energy consumed by boilers (fuel only) and/or by electric resistance heaters and heat pumps.

The efficiencies of heating equipment used to determine energy use are based on measurements and observations made during building surveys. Results are shown on Table B-5 for heating system fired equipment. Equipment is described in Appendix F.

B.2.2 Cooling Energy Use

Cooling energy use is summarized on Table B-2. Only electricity use is recorded because there are no absorption cooling devices in the EEAP buildings. The coefficients of performance (COP) used are based on measurements of operating cooling equipment and on manufacturer's data. Cooling system data is tabulated in Appendix F.

B.2.3 Auxiliary and Ventilation Equipment Energy Use

Electricity use for auxiliary and ventilating equipment is indicated on Table B-4. This equipment includes such items as boiler burner blowers, fuel pumps, air handlers and condenser fans, circulation pumps, etc. Energy use estimates are based on the operating characteristics of the various heating and cooling equipment. Operating schedules for buildings and their mechanical systems as well as the types and sizes of equipment are based on observations made during building surveys.

B.3 Domestic Hot Water Energy Usage

Energy consumption for heating domestic hot water (DHW) is a function of:

- Per capita consumption of DHW (gallons per person per day, GPCD)
- Actual temperature of DHW
- Temperature of the water supply
- Domestic hot water heating system efficiency

Table B-6 is a summary of per capita consumption data used for calculating DWH usage. This information has been developed based on guidance referenced in the table.

Domestic hot water heating system efficiencies are shown on Table B-7. Where both electric and fuel oil-fired systems are installed, the portion of the load that each system satisfies is indicated.

Temperatures used for determining existing energy consumption were measured during field investigations.

In accordance with Fort Ord Regulation 11-2, and authorized DHW temperatures, temperatures measured during field investigations are listed in Appendix C and are shown in print-outs associated with ECO C-1 Reduce Domestic Hot Water Temperatures. (See Appendix D)

The water supply temperature is assumed to be 60 degrees F during the summer and 50 degrees F during winter. An average of 55 degrees F is used in calculations.

Baseline domestic hot water energy consumption calculations appear on Table B-8.

Domestic hot water energy consumption for multiple use buildings are determined by considering occupancies and temperatures of component uses separately.

Piping and tank thermal losses are calculated separately and tabulated in Table B-8. Tank and piping loss calculations appear later in this Appendix.

B.4 Lighting Energy Consumption

Lighting energy consumption is broken down into the following categories for reporting purposes:

- Interior Lighting
- Exterior Lighting

Lighting energy usage is summarized on Table B-3. Detailed calculations appear on Table B-9.

The methodology used in calculating lighting energy use is addressed later in this Appendix. Lighting fixture type data is summarized in Appendix F.

B.5 Process Energy Usage

Process energy is any energy use which is not included under space heating, cooling, or ventilation, domestic hot water (DHW) heating (including DHW used in dining facilities and clubs) or lighting systems.

Process energy uses are determined for each type of building function. Factors are developed based on detailed considerations and metering of process energy use in several similar projects. Factors are summarized later in this Appendix. Process energy calculations are shown on Table B-10.

Most process energy consumption involves electric powered equipment and systems such as: ice machines, water coolers, vending machines, office equipment, coffee pots, televisions, other small appliances and shop equipment.

Energy usage rates for various building functions are summarized and explained later in this Appendix.

B.6 Estimated Energy Use Versus Recorded Energy Use

Estimates of energy uses for Fort Hunter-Liggett (FHL) buildings and exterior lighting systems are compared to records of FY92 fuel consumption and power generation on Table B-11. Use of the most recent complete year of energy use records for checking estimates requires fewer adjustments to account for demolitions and newly constructed facilities.

Tables B-1 through B-3 summarize results of estimated energy use for:

- Heating, ventilating and air conditioning (HVAC)
- Domestic hot water heating
- Lighting (interior and exterior)
- Process energy use

Fuel oil, propane and electricity use are addressed separately. Deliveries of fuel oil and propane to FHL buildings are compared to estimates for fuel oil using buildings on Table B-11. As can be seen, all estimates are close to 10 percent of fuel deliveries.

No records are available for fuel oil deliveries to individual buildings. Recorded consumption is based on DEH trips to fill all tanks. Propane delivery records for

individual buildings are available only for the period between 6 November 1991 and 31 August 1992. These records were normalized to a full year based on ratios of 65 degree F-based Heating Degree Hours for the periods of record and no-record.

Electric power metering is not available on a building-by-building basis. Thus, totals of estimated electricity use are compared to power plant records for each site on Table B-10. Results indicate that estimated electricity use agrees with records for FY87.

Baseline energy use calculations are, thus, validated for use as the basis from which energy conservation opportunities are evaluated. Estimated energy use is a little lower than the records indicate for all energy types. A low estimate provides for conservative analysis of energy saving opportunities.

TABLE B-1 SUMMARY BASELINE ENERGY USE

Fac No.	Facility Name	Area (SF)	Total Baseline Energy Use Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr	Energy per Floor SF Total MBTU/Yr	HVAC kBTU/SFYr
T 6	Family Housing NCO & Enl	1,090		113	14,938	163	150.0
P 41A	Family Housing NCO & Enl	1,397		60	21,587	134	95.8
P 41B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 42A	Family Housing NCO & Enl	1,937		63	23,442	143	73.8
P 42B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 43A	Family Housing NCO & Enl	1,937		63	23,442	143	73.8
P 43B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 44A	Family Housing NCO & Enl	1,937		63	23,442	143	73.8
P 44B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 45A	Family Housing NCO & Enl	1,937		63	23,442	143	73.8
P 45B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 46	Family Housing CG & WO	2,089		59	18,710	123	58.9
P 47	Family Housing CG & WO	2,089		59	18,710	123	58.9
P 51A	Family Housing NCO & Enl	1,937		63	23,442	143	73.8
P 51B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 52A	Family Housing NCO & Enl	1,937		63	23,442	143	73.8
P 52B	Family Housing NCO & Enl	1,937		43	10,130	78	40.1
P 53	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 54	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 55	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 56	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 57	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 58	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 59	Family Housing CG & WO	2,089		57	18,710	121	57.9
P 60	Family Housing CG & WO	2,089		57	18,710	121	57.9
S 79	Post Office, Main	1,000			4,028	14	13.7
P 80	Exchange, Main Retail	9,093		148	157,389	685	75.4
P 81	Theater with Dressing Rm's	6,719		150	55,915	341	50.7
P 101	Open Din Cons (Hacienda) Club (Bar) Hacienda, East Rooms Hacienda, West Rooms	6,171 3,046 4,721 8,273		1,452	235,466	2,256	101.6
P 116	Exchange Service Station (Non-shop areas)	1,126 662		35	7,153	59	33.2
T 120	Fire Station - Office Fire Station - Dorm Fire Station - Garage	3,636 2,653 4,949		948	177,017	654	58.2
T 121	Bowling Center	4,952 628		98	81,291	376	67.3
T 124	Family Housing LC & MJ	2,001		309	25,187	395	197.5
T 127	Officers Quarters Military	2,250		320	15,729	374	166.1
P 128	Officers Quarters Military	20,196		2,013	335,214	3,157	156.3
T 131	Family Housing CG & WO	998		107	14,095	155	155.4
S 144	Gymnasium	7,172		53	6,909	76	10.6

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TABLE B-1 SUMMARY BASELINE ENERGY USE

Fac No.	Facility Name	Area (SF)	Total Baseline Energy Use Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr	Energy per Floor SF Total MBTU/Yr	HVAC kBTU/SFYr
S 146	FE Facility	4,042		256	9,369	288	71.2
T 149	Family Housing NCO & Enl	1,196		203	14,692	254	212.1
T 156	FE Facility - Shop FE Facility - Office	1,753 497			12,187	42	18.5
T 158	Vehicle Storage	1,859			50	0.2	0.1
T 161	Admin General Purpose	2,250		83	16,557	140	62.1
T 162	Elec Maint. Shop	2,250		83	11,902	124	55.1
T 163	Officers Quarters Military	2,250		83	9,253	115	51.0
T 164	Admin General Purpose	2,250		83	12,977	128	56.7
T 165	Admin General Purpose	2,250		83	12,977	128	56.7
T 166	Officers Quarters Military	2,250		83	9,253	115	51.0
T 167	Officers Quarters Military	2,250		83	9,253	115	51.0
S 168	General Purp Warehouse	6,560			178	1	0.1
T 172	Cold Storage Warehouse	800			22	0	0.1
P 177	Technical Library	3,599		23	33,700	138	38.3
P 178	Child Development Cntr	3,599		143	47,537	305	84.8
S 182	Commissary	3,000		51	207,050	758	252.7
S 186	Sup Svc Admin Bldg	1,920		120	21,635	193	100.7
P 190	Post Chapel	2,720	310		45,185	464	170.7
S 197	Admin Bldg R&D - Office Admin Bldg R&D - Electronics	2,100 6,062		268	119,544	676	82.8
S 198	General Inst Bldg	1,090		49	5,304	67	61.6
P 205 P 205A	Admin General Purpose Company HQ Building	35,820 5,161	1,952		431,110	3,423	83.5
P 206	Enlisted Pers Dining Fac Kitchen Area - Scullery	16,768	4,851		336,665	6,000	357.8
P 207 P 207A	Enl Barracks w/o Dining Company HQ Building	35,820 5,161	2,420		420,291	3,855	94.1
P 208 P 208A	Enl Barracks w/o Dining Company HQ Building	35,820 5,161	2,443		426,427	3,898	95.1
P 209	AAFES Snack Bar	3,320		92	248,311	939	282.9
P 210	Hlth/Dntl Clinic w/ Beds	10,973	3,048		320,937	4,144	377.6
P 211	Outdoor Swimming Pool	-		1,211	36,436	1,335	-
P 212	Gymnasium	8,907		1,094	90,714	1,404	157.6
P 219	Physical Fitness Center	3,212		500	46,441	659	205.0
P 229 P 229A	Enl Barracks w/o Dining Company HQ Building	40,915 5,161	2,079		418,400	3,507	76.1
P 230 P 230A	Enl Barracks w/o Dining Company HQ Building	35,820 5,161	2,324		428,922	3,788	92.4
S 235	Admin General Purpose	3,000		46	32,302	157	52.2
S 236	Admin General Purpose	3,000		47	32,302	157	52.4
S 237	Admin General Purpose	3,000		115	32,302	225	75.0
S 238	Sig Photo Lab Process	14,548		555	112,807	941	64.6

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TABLE B-1 SUMMARY BASELINE ENERGY USE

Fac No.	Facility Name	Area (SF)	Total Baseline Energy Use			Energy per Floor SF	
			Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr	Total MBTU/Yr	HVAC kBTU/SFYr
P 240	Admin General Purpose	3,000		38	32,302	148	49.5
S 241	GM Facility	10,000		153	217,159	742	74.2
S 243	Admin General Purpose	3,000		33	32,302	143	47.8
S 244	Admin General Purpose	3,000		33	32,302	143	47.8
S 246	Admin General Purpose	3,000		33	32,302	143	47.8
S 247	Admin General Purpose	3,000		38	32,302	148	49.5
P 252	Vehicle Maint Shop DS	12,299	919		64,833	1,140	92.7
P 256	Vehicle Maint Shop ORG	5,294	403		30,371	507	95.7
P 259	Vehicle Maint Shop ORG	13,667	1,010		60,636	1,217	89.0
S 283	FE Maintenance Shop	4,000		143	11,329	181	45.4
S 286	Admin General Purpose	3,000		57	31,224	163	54.5
P 287	Recreation Building	5,584		193	80,676	469	83.9
S 288	General Purpose Warehouse	3,000		57	28,590	154	51.5
S 290	Electron Equip Facility	14,856		1,127	196,373	1,797	121.0
S 291	Cont Humid Warehouse	7,400		490	114,816	882	119.2
P 295	Enl Barracks w/o Dining	46,593		3,019	867,426	5,980	128.3
P 301	ADP Building	10,800		352	647,981	2,213	204.9
P 642	Detached Latrine/Shower	995		117	1,002	120	120.7
S 2201	Control Tower - Range SPT	891			1,155	4	4.4
	Bldg Totals	625,458	21,759	18,337	8,078,661	67,668	108.2
	Water Well				136,240	465	
	Exterior Lighting				197,190	673	
	Non-Scope SF	152,002			1,481,731	5,057	33.3
	Grand Total	777,460	21,759	18,337	9,893,823	73,863	95.0

TABLE B-2 SUMMARY BASELINE HVAC & DHW ENERGY USE

Fac No.	Facility Name	Baseline HVAC Energy Use			Baseline DHW Energy Use		
		Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr	Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr
T 6	Family Housing NCO & Enl		58.7	6,657		43.3	
P 41A	Family Housing NCO & Enl		17	11,456	-	32.6	
P 41B	Family Housing NCO & Enl				-	32.6	
P 42A	Family Housing NCO & Enl		20	13,312	-	32.6	
P 42B	Family Housing NCO & Enl				-	32.6	
P 43A	Family Housing NCO & Enl		20	13,312	-	32.6	
P 43B	Family Housing NCO & Enl				-	32.6	
P 44A	Family Housing NCO & Enl		20	13,312	-	32.6	
P 44B	Family Housing NCO & Enl				-	32.6	
P 45A	Family Housing NCO & Enl		20	13,312	-	32.6	
P 45B	Family Housing NCO & Enl				-	32.6	
P 46	Family Housing CG & WO		14	8,248	-	34.6	
P 47	Family Housing CG & WO		14	8,248	-	34.6	
P 51A	Family Housing NCO & Enl		19.9	13,312	-	32.6	
P 51B	Family Housing NCO & Enl				-	32.6	
P 52A	Family Housing NCO & Enl		20	13,312	-	32.6	
P 52B	Family Housing NCO & Enl				-	32.6	
P 53	Family Housing CG & WO		14	8,248	-	32.6	
P 54	Family Housing CG & WO		14	8,248	-	32.6	
P 55	Family Housing CG & WO		14	8,248	-	32.6	
P 56	Family Housing CG & WO		14	8,248	-	32.6	
P 57	Family Housing CG & WO		14	8,248	-	32.6	
P 58	Family Housing CG & WO		14	8,248	-	32.6	
P 59	Family Housing CG & WO		14	8,248	-	32.6	
P 60	Family Housing CG & WO		14	8,248	-	32.6	
S 79	Post Office, Main		-	1,565	-	-	
P 80	Exchange, Main Retail		148	14,479	-	-	20,692
P 81	Theater with Dressing Rm's		150	9,488	-	-	43,067
P 101	Open Din Cons (Hacienda)		728	18,652	-	111.8	
	Club (Bar)		359	12,941	-	29.9	
	Hacienda, East Rooms		-	134,563	-	101.5	
	Hacienda, West Rooms				-	110.9	
P 116	Exchange Service Station		35		-	-	826
	(Non-shop areas)		-	1,550			
T 120	Fire Station - Office		444	11,757	-	28.3	
	Fire Station - Dorm		324	3,459	-	151.5	
	Fire Station - Garage						
T 121	Bowling Center		53	25,990	-	45.1	
					-	-	8,599
T 124	Family Housing LC & MJ		245	14,917	-	54.2	
T 127	Officers Quarters Military		193	2,783	-	126.9	
P 128	Officers Quarters Military		1,333	109,508	-	680.1	
T 131	Family Housing CG & WO		50	6,015	-	46.8	
S 144	Gymnasium		53	418	-	0.0	

TABLE B-2 SUMMARY BASELINE HVAC & DHW ENERGY USE

Fac No.	Facility Name	Baseline HVAC Energy Use			Baseline DHW Energy Use		
		Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr	Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr
S 146	FE Facility		256	2,464	-	-	
T 149	Family Housing NCO & Enl		146	7,668	-	46.8	
T 156	FE Facility - Shop		-	823	-	-	979
	FE Facility - Office						
T 158	Vehicle Storage		-	0	-	-	
T 161	Admin General Purpose		83	5,878	-	-	
T 162	Elec Maint. Shop		83	5,878	-	-	
T 163	Officers Quarters Military		83	5,878	-	-	
T 164	Admin General Purpose		83	5,878	-	-	
T 165	Admin General Purpose		83	5,878	-	-	
T 166	Officers Quarters Military		83	5,878	-	-	
T 167	Officers Quarters Military		83	5,878	-	-	
S 168	General Purp Warehouse	No Heat	No Heat	No Heat	-	-	
T 172	Cold Storage Warehouse	No Heat	No Heat	No Heat	-	-	
P 177	Technical Library		23	14,395	-	-	
P 178	Child Development Cntr		86	17,993	-	56.7	
S 182	Commissary		51	5,643	-	-	3,585
S 186	Sup Svc Admin Bldg		120	8,677	-	-	
P 190	Post Chapel	310	-	36,505	-	-	2,726
S 197	Admin Bldg R&D - Office		268	16,361	-	-	931
	Admin Bldg R&D - Electronics		-	62,202			
S 198	General Inst Bldg		49	356	-	-	
P 205	Admin General Purpose	1,867	0	272,346	84.6	-	
P 205A	Company HQ Building				-	-	647
P 206	Enlisted Pers Dining Fac	3,945	-	108,696	905.8	-	
	Kitchen Area - Scullery				-	-	
P 207	Enl Barracks w/o Dining	1,867	-	268,570	553.3	-	
P 207A	Company HQ Building				-	-	776
P 208	Enl Barracks w/o Dining	1,867	-	269,875	575.9	-	
P 208A	Company HQ Building				-	-	909
P 209	AAFES Snack Bar		92	68,438	-	-	67,115
P 210	Hlth/Dntl Clinic w/ Beds	1,025	-	154,590	2,023.9	-	
P 211	Outdoor Swimming Pool		1,211	36,436	-	0.0	
P 212	Gymnasium		1,071	49,087	-	22.9	
P 219	Physical Fitness Center		430	17,812	-	70.1	
P 229	Enl Barracks w/o Dining	1,867	0	286,869	212.1	-	
P 229A	Company HQ Building				-	-	688
P 230	Enl Barracks w/o Dining	1,867	0	276,484	457.0	-	
P 230A	Company HQ Building				-	-	794
S 235	Admin General Purpose		46	18,805	-	-	
S 236	Admin General Purpose		47	18,805	-	-	
S 237	Admin General Purpose		115	18,805	-	-	
S 238	Sig Photo Lab		508	31,024	-	47.5	
	Process				-	35.6	

TABLE B-2 SUMMARY BASELINE HVAC & DHW ENERGY USE

Fac No.	Facility Name	Baseline HVAC Energy Use			Baseline DHW Energy Use		
		Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr	Fuel Oil MBTU/Yr	Propane MBTU/Yr	Electric KWH/Yr
P 240	Admin General Purpose		38	18,805	-	-	
S 241	GM Facility		153	162,971	-	-	3,009
S 243	Admin General Purpose		33	18,805	-	-	
S 244	Admin General Purpose		33	18,805	-	-	
S 246	Admin General Purpose		33	18,805	-	-	
S 247	Admin General Purpose		38	18,805	-	-	
P 252	Vehicle Maint Shop DS	919	-	27,085	-	-	3,715
P 256	Vehicle Maint Shop ORG	403	-	10,742	-	-	4,980
P 259	Vehicle Maint Shop ORG	1,010	-	19,377	-	-	3,440
S 283	FE Maintenance Shop		143	509	-	-	
S 286	Admin General Purpose		57	18,805	-	-	
P 287	Recreation Building		132	53,904	-	61.5	
S 288	General Purpose Warehouse		57	18,805	-	-	
S 290	Electron Equip Facility		1,064	150,755	-	62.4	
S 291	Cont Humid Warehouse		490	96,071	-	-	
P 295	Enl Barracks w/o Dining	0	2,199	703,890	-	819.8	
P 301	ADP Building		352	95,034	-	-	1,898
P 642	Detached Latrine/Shower		-	19	-	116.7	
S 2201	Control Tower - Range SPT		-	349	-	-	
	Bldg Totals	16,946	14,375	4,111,758	4,813	3,657	169,376
	Water Well						
	Exterior Lighting						
	Non-Scope SF	Nil	Nil	999,260	Nil	Nil	Nil
	Grand Total	16,946	14,375	5,111,018	4,813	3,657	169,376

TABLE B-3 SUMMARY BASELINE LIGHTING & PROCESS ENERGY USE

Fac No.	Facility Name	Area (SF)	Lighting Energy kWH/Yr	Baseline Process Energy Use Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking/Other Prop MBTU/Yr
T 6	Family Housing NCO & Enl	1,090	2,381	5,900	Included	10.5
P 41A	Family Housing NCO & Enl	1,397	4,230	5,900	Included	10.5
P 41B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 42A	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 42B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 43A	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 43B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 44A	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 44B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 45A	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 45B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 46	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 47	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 51A	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 51B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 52A	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 52B	Family Housing NCO & Enl	1,937	4,230	5,900	Included	10.5
P 53	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 54	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 55	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 56	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 57	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 58	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 59	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
P 60	Family Housing CG & WO	2,089	4,562	5,900	Included	10.5
S 79	Post Office, Main	1,000	764	1,700		
P 80	Exchange, Main Retail	9,093	10,134	112,084		
P 81	Theater with Dressing Rm's	6,719	2,301	1,058		
P 101	Open Din Cons (Hacienda)	6,171	8,423	0	39,420	
	Club (Bar)	3,046		6,092	5,475	
	Hacienda, East Rooms	4,721		4,000		
	Hacienda, West Rooms	8,273		5,900	Included	10.5
P 116	Exchange Service Station	1,126	3,170	481		
	(Non-shop areas)	662		1,126		
T 120	Fire Station - Office	3,636	148,678	3,291		
	Fire Station - Dorm	2,653		2,800	6,899	
	Fire Station - Garage	4,949		134		
T 121	Bowling Center	4,952	23,600	4,482	5,475	
		628		13,144		
T 124	Family Housing LC & MJ	2,001	4,370	5,900	Included	10.5
T 127	Officers Quarters Military	2,250	8,946	4,000		
P 128	Officers Quarters Military	20,196	141,146	32,000	52,560	
T 131	Family Housing CG & WO	998	2,180	5,900	Included	10.5
S 144	Gymnasium	7,172		6,491		

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TABLE B-3 SUMMARY BASELINE LIGHTING & PROCESS ENERGY USE

Fac No.	Facility Name	Area (SF)	Lighting Energy kWH/Yr	Baseline Process Energy Use: Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking/Other Prop MBTU/Yr
S 146	FE Facility	4,042	5,179	1,727		
T 149	Family Housing NCO & Enl	1,196	1,124	5,900	Included	10.5
T 156	FE Facility - Shop	1,753	9,186	749		
	FE Facility - Office	497		450		
T 158	Vehicle Storage	1,859		50		
T 161	Admin General Purpose	2,250	8,643	2,036		
T 162	Elec Maint. Shop	2,250	5,063	961		
T 163	Officers Quarters Military	2,250	3,375	NA		
T 164	Admin General Purpose	2,250	5,063	2,036		
T 165	Admin General Purpose	2,250	5,063	2,036		
T 166	Officers Quarters Military	2,250	3,375	NA		
T 167	Officers Quarters Military	2,250	3,375	NA		
S 168	General Purp Warehouse	6,560		178		
T 172	Cold Storage Warehouse	800		22	Also see Bldg 182	
P 177	Technical Library	3,599	16,048	3,257		
P 178	Child Development Cntr	3,599	19,089	272	10,184	
S 182	Commissary	3,000	25,040	172,782		
S 186	Sup Svc Admin Bldg	1,920	11,221	1,738		
P 190	Post Chapel	2,720	3,253	1,058	1,643	
S 197	Admin Bldg R&D - Office	2,100	35,560	1,901		
	Admin Bldg R&D - Electronics	6,062		2,589		
S 198	General Inst Bldg	1,090	3,961	986		
P 205	Admin General Purpose	35,820	90,837	32,417		
P 205A	Company HQ Building	5,161	30,192	4,671		
P 206	Enlisted Pers Dining Fac	16,768	43,023		184,946	
	Kitchen Area - Scullery					
P 207	Enl Barracks w/o Dining	35,820	84,082	32,000		
P 207A	Company HQ Building	5,161	30,192	4,671		
P 208	Enl Barracks w/o Dining	35,820	84,781	36,000		
P 208A	Company HQ Building	5,161	30,192	4,671		
P 209	AAFES Snack Bar	3,320	7,568	6,640	98,550	
P 210	Hlth/Dntl Clinic w/ Beds	10,973	126,081	37,308	2,957	
P 211	Outdoor Swimming Pool	-				
P 212	Gymnasium	8,907	33,566	8,061		
P 219	Physical Fitness Center	3,212	25,722	2,907		
P 229	Enl Barracks w/o Dining	40,915	84,781	11,200		
P 229A	Company HQ Building	5,161	30,192	4,671		
P 230	Enl Barracks w/o Dining	35,820	84,781	32,000		
P 230A	Company HQ Building	5,161	30,192	4,671		
S 235	Admin General Purpose	3,000	10,783	2,715		
S 236	Admin General Purpose	3,000	10,783	2,715		
S 237	Admin General Purpose	3,000	10,783	2,715		
S 238	Sig Photo Lab	14,548	52,191	13,166	-	
	Process			16,425		

TABLE B-3 SUMMARY BASELINE LIGHTING & PROCESS ENERGY USE

Fac No.	Facility Name	Area (SF)	Lighting Energy kWH/Yr	Baseline Process Energy Use: Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking/Other Prop MBTU/Yr
P 240	Admin General Purpose	3,000	10,783	2,715		
S 241	GM Facility	10,000	42,129	9,050		
S 243	Admin General Purpose	3,000	10,783	2,715		
S 244	Admin General Purpose	3,000	10,783	2,715		
S 246	Admin General Purpose	3,000	10,783	2,715		
S 247	Admin General Purpose	3,000	10,783	2,715		
P 252	Vehicle Maint Shop DS	12,299	28,780	5,254		
P 256	Vehicle Maint Shop ORG	5,294	12,388	2,261		
P 259	Vehicle Maint Shop ORG	13,667	31,981	5,838		
S 283	FE Maintenance Shop	4,000	9,112	1,709		
S 286	Admin General Purpose	3,000	9,704	2,715		
P 287	Recreation Building	5,584	15,604	11,168		
S 288	General Purpose Warehouse	3,000	9,704	81		
S 290	Electron Equip Facility	14,856	39,273	6,346		
S 291	Cont Humid Warehouse	7,400	15,584	3,161		
P 295	Enl Barracks w/o Dining	46,593	117,936	45,600		
P 301	ADP Building	10,800	46,003	9,774 495,272		
P 642	Detached Latrine/Shower	995	983			
S 2201	Control Tower - Range SPT	891		806		
	Bldg Totals	625,458	1,958,377	1,431,044	408,107	304.5
	Water Well			136,240		
	Exterior Lighting		197,190			
	Non-Scope SF	152,002	475,935	6,536	Shop/Wh	
	Grand Total	777,460	2,631,502	1,573,820	408,107	304.5

Table B-4 Baseline HVAC Energy Use Calculations Results

Fac No.	HVAC Estimate Basis	Primary Heating Energy Use Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Primary Cooling Energy Use Compressor kWH/Yr	CT/Cond kWH/Yr	Cond Pmp kWH/Yr	Other Acc kWH/Yr	Auxiliary Energy Use SA Fans kWH/Yr	Circ Pmp kWH/Yr	Base Util kWH/Yr	Total HVAC Energy Use Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	HVAC Energy per Floor SF Total MBTU/Yr	HVAC k BTU/SF-Yr
T 6	BIN	-	58.7	-	5,500	All components included			1,157	0	0	6,657	58.7	-	81.4	74.7
P 41A	ID to P51A	1,190	17	0	7,590	835	0	727	1,114	0	0	11,456	17	0	56.2	16.9
P 41B	Incl @ P51A															
P 42A	ID to P51A	1,383	20	0	8,820	970	0	845	1,294	0	0	13,312	20	0	65.3	16.9
P 42B	Incl @ P51A															
P 43A	ID to P51A	1,383	20	0	8,820	970	0	845	1,294	0	0	13,312	20	0	65.3	16.9
P 43B	Incl @ P51A															
P 44A	ID to P51A	1,383	20	0	8,820	970	0	845	1,294	0	0	13,312	20	0	65.3	16.9
P 44B	Incl @ P51A															
P 45A	ID to P51A	1,383	20	0	8,820	970	0	845	1,294	0	0	13,312	20	0	65.3	16.9
P 45B	Incl @ P51A															
P 46	Trace 600	930	14.0	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 47	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 51A	Trace 600	1,383	19.9	0	8,820	970	0	845	1,294	0	0	13,312	19.9	0	65.3	16.9
P 51B	Incl @ P51A															
P 52A	ID to P51A	1,383	20	0	8,820	970	0	845	1,294	0	0	13,312	20	0	65.3	16.9
P 52B	Incl @ P51A															
P 53	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 54	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 55	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 56	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 57	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 58	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 59	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
P 60	ID to P46	930	14	0	5,757	666	0	410	485	0	0	8,248	14	0	42.2	20.2
S 79	Manual	1,080	-	-	485	-	-	-	-	-	-	1,565	-	-	5.3	5.3
P 80	Trace 600	1,638	148	-	11,449	1,001	0	377	Included	14	0	14,479	148	-	197.7	21.7
P 81	Sim to P80	-	150	-	8,460	740	0	279	0	10	0	9,488	150	-	182.4	27.1
P 101	BIN	80	728	-	14,000	Included	Included	750	3,058	764	0	18,652	728	-	1,654.6	118.7
	BIN	119	359	-	9,000	Included	Included	-	3,058	764	0	12,941	359	-		
	Manual	131,393	-	-	1,492	Included	Included	1,679	Included	0	0	134,563	-	-		
P 116	BIN	-	35.0	-	0	0	0	0	999	0	0		35	-	40.3	22.5
	Sim to P80	616	-	0	834	73	0	27	Included	0	0	1,550	-	0		
T 120	BIN	-	444	-	6,234	Included	Included	2,190	3,333	0	0	11,757	444	-	820.5	73.0
	BIN	-	324	-	0	Included	Included	3,459	Included	0	0	3,459	324	-		
	Manual	-	0	-	0	0	0	0	0	0	0					
T 121	Trace 600	5,787	53.0	-	11,475	1,511	0	650	6,568	0	0	25,990	53	-	141.7	28.6
T 124	Sim to T6	0	245	-	10,097	0	0	0	4,820	0	0	14,917	245	-	295.4	147.6
T 127	BIN	501	193	-	1,153	Evap Clr	0	0	1,129	0	0	2,783	193	-	202.6	90.1
P 128	Trace 600	3,582	1,333	0	60,321	6,728	0	1,276	24,480	13,121	0	109,508	1,333	0	1,706.7	84.5
T 131	Sim to T6	0	49.7	0	5,036	0	0	0	979	0	0	6,015	50	0	70.2	70.3

Table B-4 Baseline HVAC Energy Use Calculations Results

Fac No.	HVAC Estimate Basis	Primary Heating Energy Use Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Primary Cooling Energy Use Compressor kWH/Yr	CT/Cond kWH/Yr	Cond Pmp kWH/Yr	Other Acc kWH/Yr	Auxiliary Energy Use SA Fans kWH/Yr	Circ Pmp kWH/Yr	Base Util kWH/Yr	Total HVAC Energy Use Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	HVAC Energy per Floor SF Total MBTU/Yr	HVAC k BTU/SF-Yr
S 144	Manual	-	52.5	-	0	0	0	103	315	0	0	418	53	-	53.9	7.5
S 146	Manual	-	256	-	0	0	0	617	1,847	0	0	2,464	256	-	264.3	65.4
T 149	Sim to T6	0	146	0	6,035	0	0	0	1,633	0	0	7,668	146	0	172.3	144.1
T 156	Manual	-	-	-	823	0	0	0	0	0	0	823	-	-	2.8	1.6
	Manual	-	-	-												
T 158	Manual	-	-	-	0	0	0	0	0	0	0	0	-	-	-	-
T 161	BIN	-	83.3	-	4,470	Included	0	0	1,408	0	0	5,878	83	-	103.3	45.9
T 162	Sim to T161	0	83.3	0	4,470	0	0	0	1,408	0	0	5,878	83	0	103.3	45.9
T 163	Sim to T161	0	83.3	0	4,470	0	0	0	1,408	0	0	5,878	83	0	103.3	45.9
T 164	Sim to T161	0	83.3	0	4,470	0	0	0	1,408	0	0	5,878	83	0	103.3	45.9
T 165	Sim to T161	0	83.3	0	4,470	0	0	0	1,408	0	0	5,878	83	0	103.3	45.9
T 166	Sim to T161	0	83.3	0	4,470	0	0	0	1,408	0	0	5,878	83	0	103.3	45.9
T 167	Sim to T161	0	83.3	0	4,470	0	0	0	1,408	0	0	5,878	83	0	103.3	45.9
S 168	Manual	No Heat	No Heat	No Heat	0	0	0	0	0	0	0	0	No Heat	No Heat	-	-
T 172	Manual	No Heat	No Heat	No Heat	0	0	0	0	0	0	0	0	No Heat	No Heat	-	-
P 177	Trace 600	-	22.8	-	12,779	1,193	0	99	324	0	0	14,395	23	-	71.9	20.0
P 178	Sim to P177	0	86	0	15,974	1,491	0	124	404	0	0	17,993	86	0	147.6	41.0
S 182	Trace 600	0	51	0	5,067	500	0	76	Included	0	0	5,643	51	0	70.7	23.6
S 186	BIN	-	119.5	-	7,546	Included	Included	Included	1,131	0	0	8,677	120	-	149.1	77.7
P 190	Trace/Manual	163	-	310	34,548	Included	0	320	573	901	0	36,505	-	310	434.6	159.8
S 197	BIN	-	268.1	-	12,691	Included	Included	Included	3,670	0	0	16,361	268	-	536.2	65.7
	BIN	47,302	-	-	6,440	Included	Included	Included	8,460	0	0	62,202	-	-		
S 198	BIN	-	49	-	144	Evap Cooler		0	212	0	0	356	49	-	50.3	46.1
P 205	ID to 207	398	0	1,867	75,217	Included	0	7,118	188,682	931	0	272,346	0	1,867	2,796.5	68.2
P 205A	Incl @ P207															
P 206	Trace/Manual	0	-	3,945	49,146	Included	0	20,613	38,691	246	0	108,696	-	3,945	4,315.7	257.4
	Incl @ P206															
P 207	Trace/Manual	398	-	1,867	75,217	Included	0	7,118	184,906	931	0	268,570	-	1,867	2,783.6	67.9
P 207A	Incl @ P207															
P 208	ID to 207	398	-	1,867	79,355	Included	0	7,118	182,073	931	0	269,875	-	1,867	2,788.1	68.0
P 208A	Incl @ P207															
P 209	BIN/Manual	-	92	-	43,780	2,090	0	1,327	20,578	663	0	68,438	92	-	325.2	98.0
P 210	Trace 600	7,201	-	1,025	25,095	3,309	0	1,004	112,946	5,035	0	154,590	-	1,025	1,552.2	141.5
P 211	Manual	1,392	1,211	-	0	0	0	0	0	35,044	0	36,436	1,211	-	1,335.1	NA
P 212	Sim to B219	-	1,071	-	12,612	0	0	26,022	8,041	2,413	0	49,087	1,071	-	1,238.6	139.1
P 219	Trace/Manual	110	430	-	4,548	Evap Clrs	0	9,384	2,900	870	0	17,812	430	-	490.8	152.8
P 229	Trace/Manual	398	0	1,867	79,355	Included	0	7,118	199,067	931	0	286,869	0	1,867	2,846.1	61.8
P 229A	Incl @ P229															
P 230	ID to P229	398	0	1,867	79,355	Included	0	7,118	188,682	931	0	276,484	0	1,867	2,810.6	68.6
P 230A	Incl @ P229															
S 235	ID to P240	8,936	46.4	0	8,936	728	0	205	0	0	0	18,805	46	0	110.6	36.9
S 236	ID to P240	8,936	46.9	0	8,936	728	0	205	0	0	0	18,805	47	0	111.0	37.0
S 237	ID to P240	8,936	114.9	0	8,936	728	0	205	0	0	0	18,805	115	0	179.1	59.7

Table B-4 Baseline HVAC Energy Use Calculations Results

Fac No.	HVAC Estimate Basis	Primary Heating Energy Use			Primary Cooling Energy Use				Auxiliary Energy Use			Total HVAC Energy Use			HVAC Energy per Floor SF	
		Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Compressor kWH/Yr	CT/Cond kWH/Yr	Cond Pmp kWH/Yr	Other Acc kWH/Yr	SA Fans kWH/Yr	Circ Pmp kWH/Yr	Base Util kWH/Yr	Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Total MBTU/Yr	HVAC k BTU/SF-Yr
S 238	Trace 600	1,336	508	0	20,210	2,396	0	3,423	3,650	9	0	31,024	508	0	613.8	42.2
P 240	Trace 600	8,936	38	0	8,936	728	0	205	Included	0	0	18,805	38	0	102.4	34.1
S 241	Trace 600	12,231	153	0	16,565	2,186	0	2,451	125,528	4,009	0	162,971	153	0	709.3	70.9
S 243	ID to P240	8,936	33	0	8,936	728	0	205	0	0	0	18,805	33	0	97.2	32.4
S 244	ID to P240	8,936	33	0	8,936	728	0	205	0	0	0	18,805	33	0	97.2	32.4
S 246	ID to P240	8,936	33	0	8,936	728	0	205	0	0	0	18,805	33	0	97.2	32.4
S 247	ID to P240	8,936	38	0	8,936	728	0	205	0	0	0	18,805	38	0	102.4	34.1
P 252	BIN	14,280	-	919	4,480	Included	Included	2,253	3,621	2,451	0	27,085	-	919	1,011	82.2
P 256	BIN	4,577	-	403	700	Included	Included	2,150	1,681	1,634	0	10,742	-	403	440	83.0
P 259	ID to P 252	9,102	-	1,010	0	Included	Included	3,686	4,138	2,451	0	19,377	-	1,010	1,076	78.7
S 283	Manual	-	143	-	0	-	-	154	355			509	143	-	145	36.1
S 286	ID to P240	8,936	57	0	8,936	728	0	205	0	0	0	18,805	57	0	121	40.3
P 287	BIN/Manual	505	132	-	18,628	2,832	0	436	31,504			53,904	132	-	316	56.5
S 288	ID to P240	8,936	57	0	8,936	728	0	205	0	0	0	18,805	57	0	121	40.3
S 290	Trace 600	4,806	1,064	-	12,581	1,554	0	723	128,266	2,825	0	150,755	1,064	-	1,579	106.3
S 291	Trace 600	3,276	490	0	7,727	738	0	673	83,633	24	0	96,071	490	0	818	110.6
P 295	Trace 600	11,696	2,199	0	167,874	16,905	0	1,891	490,498	15,026	0	703,890	2,199	0	4,602	98.8
P 301	Trace 600	154	352 -	- -	25,048	2,997	0	5,994	60,841	0	0	95,034	352	-	676	62.6
P 642	Manual	19	-	-	0	0	0	0	0	0	0	19	-	-	0.06	0.1
S 2201	BIN	283	-	-	66	Included	0	0	Included	0	0	349	-	-	1.19	1.3
Totals		373,367	14,375	16,946	1,283,865	68,842	0	141,738	2,152,015	92,930	0	4,111,758	14,375	16,946	45,355	72.5

TABLE B-5 EXISTING HEATING EQUIPMENT EFFICIENCIES SERVING EEAP BUILDINGS

Fac No.	Heating System Losses						
	Firing Eff %	Auxilliary %	Radient %	Convection %	Shut-Down %	General %	Net Eff %
T 6	80.0%	-	8.0%	3.0%	2.0%	1.0%	66.0%
P 41A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 41B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 42A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 42B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 43A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 43B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 44A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 44B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 45A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 45B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 46	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 47	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 51A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 51B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 52A	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 52B	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 53	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 54	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 55	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 56	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 57	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 58	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 59	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
P 60	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
S 79	-	-	-	-	-	-	-
P 80	84.5%	-	8.0%	4.0%	2.0%	2.0%	68.5%
P 81	85.0%	-	4.0%	3.0%	2.0%	2.0%	74.0%
P 101	82.9%	-	6.0%	4.0%	2.0%	3.0%	67.9%
	Same	Same	Same	Same	Same	Same	Same
	-	-	-	-	-	-	-
	Included	Included	Included	Included	Included	Included	Included
P 116	85.0%	-	4.0%	3.0%	2.0%	2.0%	74.0%
	7.15 Btu/W-Hr	-	-	-	-	-	-
T 120	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
	80.0%	-	6.0%	4.0%	2.0%	2.0%	66.0%
	75.0%	-	10.0%	4.0%	2.0%	3.0%	56.0%
T 121	75.0%	-	4.0%	3.0%	2.0%	2.0%	64.0%
T 124	80.0%	-	8.0%	3.0%	2.0%	2.0%	65.0%
T 127	80.0%	-	8.0%	4.0%	2.0%	2.0%	64.0%
P 128	89.0%	-	8.0%	4.0%	2.0%	2.0%	73.0%
T 131	80.0%	-	10.0%	4.0%	2.0%	3.0%	61.0%
S 144	80.0%	-	6.0%	3.0%	2.0%	2.0%	67.0%
S 146	80.0%	-	8.0%	5.0%	2.0%	3.0%	62.0%
T 149	80.0%	-	8.0%	3.0%	2.0%	2.0%	65.0%
T 156	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
T 158	-	-	-	-	-	-	-
T 161	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
T 162	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
T 163	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%

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TABLE B-5 EXISTING HEATING EQUIPMENT EFFICIENCIES SERVING EEAP BUILDINGS

Fac No.	Heating System Losses						
	Firing Eff %	Auxilliary %	Radient %	Convection %	Shut-Down %	General %	Net Eff %
T 164	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
T 165	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
T 166	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
T 167	80.0%	-	4.0%	2.0%	1.0%	1.0%	72.0%
S 168	-	-	-	-	-	-	-
T 172	-	-	-	-	-	-	-
P 177	78.4%	-	5.0%	3.0%	2.0%	2.0%	66.4%
P 178	80.0%	3.0%	5.0%	3.0%	2.0%	2.0%	65.0%
S 182	77.0%	2.0%	5.0%	3.0%	2.0%	2.0%	63.0%
S 186	78.0%	-	5.0%	3.0%	2.0%	2.0%	66.0%
P 190	85.7%	-	5.0%	3.0%	2.0%	2.0%	73.7%
S 197	86.0%	-	8.0%	5.0%	2.0%	2.0%	69.0%
	-	-	-	-	-	-	-
S 198	80.0%	-	5.0%	3.0%	2.0%	2.0%	68.0%
P 205	87.7%	-	7.0%	4.0%	2.0%	3.0%	71.7%
P 205A	87.7%	-	7.0%	4.0%	2.0%	3.0%	71.7%
P 206	86.8%	-	7.0%	4.0%	2.0%	3.0%	70.8%
P 207	87.4%	-	7.0%	4.0%	2.0%	3.0%	71.4%
P 207A	87.4%	-	7.0%	4.0%	2.0%	3.0%	71.4%
P 208	88.1%	-	7.0%	4.0%	2.0%	3.0%	72.1%
P 208A	88.1%	-	7.0%	4.0%	2.0%	3.0%	72.1%
P 209	77.2%	-	6.0%	5.0%	2.0%	3.0%	61.2%
P 210	81.1%	-	4.0%	3.0%	2.0%	2.0%	70.1%
P 211	77.2%	-	5.0%	3.0%	2.0%	2.0%	65.2%
P 212	81.7%	-	6.0%	4.0%	2.0%	3.0%	66.7%
P 219	79.0%	-	6.0%	3.0%	1.0%	2.0%	67.0%
P 229	87.9%	-	7.0%	4.0%	2.0%	3.0%	71.9%
P 229A	87.9%	-	7.0%	4.0%	2.0%	3.0%	71.9%
P 230	87.2%	-	7.0%	4.0%	2.0%	3.0%	71.2%
P 230A	87.2%	-	7.0%	4.0%	2.0%	3.0%	71.2%
S 235	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 236	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 237	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 238	81.9%	-	5.0%	4.0%	2.0%	2.0%	68.9%
P 240	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 241	83.6%	-	8.0%	4.0%	2.0%	3.0%	66.6%
	-	-	-	-	-	-	0.0%
S 243	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 244	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 246	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
S 247	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
P 252	84.0%	-	4.0%	3.0%	2.0%	2.0%	73.0%
P 256	82.7%	-	4.0%	3.0%	2.0%	2.0%	71.7%
P 259	84.9%	-	4.0%	3.0%	2.0%	2.0%	73.9%
S 283	80.0%	-	4.0%	2.0%	2.0%	3.0%	69.0%
	-	-	-	-	-	-	-
S 286	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%
P 287	75.0%	-	4.0%	3.0%	2.0%	2.0%	64.0%
S 288	77.0%	-	4.0%	3.0%	1.0%	2.0%	67.0%

TABLE B-5 EXISTING HEATING EQUIPMENT EFFICIENCIES SERVING EEAP BUILDINGS

Fac No.	Heating System Losses						
	Firing Eff %	Auxilliary %	Radient %	Convection %	Shut-Down %	General %	Net Eff %
S 290	80.8% -	- -	8.0% -	4.0% -	2.0% -	3.0% -	63.8% -
S 291	78.8%	3.0%	7.0%	4.0%	2.0%	3.0%	59.8%
P 295	77.7%	-	8.0%	5.0%	2.0%	3.0%	59.7%
P 301	84.0% -	- -	6.0% -	3.0% -	2.0% -	2.0% -	71.0% -
P 642	-	-	-	-	-	-	-
S 2201	-	-	-	-	-	-	-
Totals							

Table B-6

Domestic Hot Water Consumption Rate Data

Function Code	Description of Usage	Gallons per Capita Day		Lo-Flow GPCD's		Basis of GPCD Data
		Non-Cooking	Cooking	Non-Cooking	Cooking	
1	Offices	2.00	0.00	1.10	0.00	TM 5-810-5, Chapter 4.
2	Shops and Warehouses	5.00	0.00	3.50	0.00	TM 5-810-5, Chapter 4.
2.1	Commercial Laundries	Separate Calculations		Separate Calculations		
3	Barracks & Quarters w/o Dining	30.00	0.00	14.93	0.00	TM 5-810-5, Chapter 4.
3.1	Detached Latrine with Bathing	24.00	0.00	8.93	0.00	TM 5-810-5, Chapter 4.
4	Barracks & Quarters with Dining	30.00	3.33	14.93	3.33	TM 5-810-5, Chapter 4.
5	Recreation & Gyms w/o Bathing	0.50	3.33	0.35	3.33	TM 5-810-5, Chapter 4, assumes 1/4 Code 1 restroom usage
5.1	Recreation & Gyms with Bathing	12.00	3.33	4.58	3.33	TM 5-810-5, Chapter 4.
6	Theaters / Community Facilities	0.50	3.33	0.35	3.33	TM 5-810-5, Chapter 4, assumes 1/4 Code 1 restroom usage
7	Dining Facilities, all uses	0.25	3.33	0.18	3.33	TM 5-810-5, Chapter 4, assumes 1/8 Code 1 restroom usage
8	Base Exchanges & Stores	0.50	3.33	0.35	3.33	TM 5-810-5, Chapter 4, assumes 1/4 Code 1 restroom usage
8.1	Commissaries	0.50	3.33	0.35	3.33	TM 5-810-5, Chapter 4, assumes 1/4 Code 1 restroom usage
9	Clubs, Officers, NCO, Enl PN	2.00	3.33	1.10	3.33	TM 5-810-5, Chapter 4, allowance for hand & bar washing
10	Family Housing (Total incl Cooking)	40.00	Included	17.80	Included	TM 5-810-5, Chapter 4.
11.1	Schools w/o Bathing	5.00	3.33	1.63	3.33	TM 5-810-5, Chapter 4.
11.2	Schools with Bathing	11.00	3.33	3.73	3.33	TM 5-810-5, Chapter 4, Code 11.1 plus assume 1/2 shower daily.
11.3	Child Development Centers	8.00	3.33	2.00	3.33	Added usage from Function Code 11.1 for diapering, etc.
12	Medical Facilities, Clinics	20.00	3.33	20.00	3.33	TM 5-810-5, Chapter 4, assumed less than in-patient care
12.1	Medical Facilities, Hospitals	120.00	3.33	120.00	3.33	Per Patient: TM 5-810-5, Chapter 4.
13	Multiple Usage Buildings	Separate Calculations		Separate Calculations		

TABLE B-7 EXISTING DOMESTIC HOT WATER HEATING EQUIPMENT EFFICIENCIES SERVING EEAP BUILDINGS

Fac No.	DHW Plant Efficiency							
	Firing Eff	Auxilliar	Radiant	Convection	Shut-Down	General	Plant Losses	Net Eff
T 6	70.0%	-	4.0%	3.0%	2.0%	2.0%	11.0%	59.0%
P 41A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 41B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 42A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 42B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 43A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 43B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 44A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 44B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 45A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 45B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 46	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 47	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 51A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 51B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 52A	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 52B	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 53	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 54	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 55	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 56	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 57	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 58	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 59	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
P 60	76.1%	-	4.0%	2.0%	1.0%	1.0%	8.0%	68.1%
S 79	-	-	-	-	-	-	-	-
P 80	-	-	-	-	-	-	-	-
P 81	-	-	-	-	-	-	-	-
P 101	70.0%	-	8.0%	5.0%	2.0%	3.0%	18.0%	52.0%
	70.0%	-	4.0%	4.0%	2.0%	2.0%	12.0%	58.0%
	70.1%	-	4.0%	3.0%	2.0%	2.0%	11.0%	59.1%
	70.8%	-	4.0%	3.0%	1.0%	1.0%	9.0%	61.8%
P 116	-	-	-	-	-	-	-	-
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
T 120	75.2%	-	6.0%	4.0%	2.0%	3.0%	15.0%	60.2%
	70.1%	-	6.0%	4.0%	2.0%	3.0%	15.0%	55.1%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
T 121	70.0%	-	6.0%	4.0%	2.0%	2.0%	14.0%	56.0%
	-	-	-	-	-	-	0.0%	-
T 124	70.0%	-	4.0%	4.0%	2.0%	2.0%	12.0%	58.0%
T 127	70.1%	-	4.0%	3.0%	2.0%	1.0%	10.0%	60.1%
P 128	75.2%	-	5.0%	3.0%	2.0%	2.0%	12.0%	63.2%
T 131	70.0%	-	4.0%	4.0%	2.0%	2.0%	12.0%	58.0%
S 144	70.1%	-	6.0%	4.0%	2.0%	2.0%	14.0%	56.1%
S 146	-	-	-	-	-	-	-	-
T 149	70.0%	-	4.0%	4.0%	2.0%	2.0%	12.0%	58.0%
T 156	-	-	-	-	-	-	-	-
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
T 158	-	-	-	-	-	-	-	-
T 161	-	-	-	-	-	-	-	-
T 162	-	-	-	-	-	-	-	-
T 163	-	-	-	-	-	-	-	-

TABLE B-7 EXISTING DOMESTIC HOT WATER HEATING EQUIPMENT EFFICIENCIES SERVING EEAP BUILDINGS

Fac No.	DHW Plant Efficiency							
	Firing Eff	Auxilliar	Radiant	Convection	Shut-Down	General	Plant Losses	Net Eff
T 164	-	-	-	-	-	-	-	-
T 165	-	-	-	-	-	-	-	-
T 166	-	-	-	-	-	-	-	-
T 167	-	-	-	-	-	-	-	-
S 168	-	-	-	-	-	-	-	-
T 172	-	-	-	-	-	-	-	-
P 177	-	-	-	-	-	-	-	-
P 178	80.0%	-	4.0%	3.0%	2.0%	1.0%	10.0%	70.0%
S 182	-	-	-	-	-	-	-	-
S 186	-	-	-	-	-	-	-	-
P 190	-	-	-	-	-	-	-	-
S 197	-	-	-	-	-	-	-	-
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	0.0%
S 198	-	-	-	-	-	-	-	-
P 205	87.7%	-	7.0%	4.0%	2.0%	3.0%	16.0%	71.7%
P 205A	-	-	-	-	-	-	-	-
P 206	86.8%	-	7.0%	4.0%	2.0%	3.0%	16.0%	70.8%
	Dish W	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
P 207	87.4%	-	7.0%	4.0%	2.0%	3.0%	16.0%	71.4%
P 207A	-	-	-	-	-	-	-	-
P 208	88.1%	-	7.0%	4.0%	2.0%	3.0%	16.0%	72.1%
P 208A	-	-	-	-	-	-	-	-
P 209	-	-	-	-	-	-	-	-
P 210	70.0%	-	5.0%	3.0%	2.0%	2.0%	12.0%	58.0%
P 211	81.0%	-	6.0%	4.0%	2.0%	3.0%	15.0%	66.0%
P 212	70.1%	-	6.0%	4.0%	2.0%	2.0%	14.0%	56.1%
P 219	75.9%	-	5.0%	3.0%	1.0%	2.0%	11.0%	64.9%
P 229	87.9%	-	7.0%	4.0%	2.0%	3.0%	16.0%	71.9%
P 229A	-	-	-	-	-	-	-	-
P 230	87.2%	-	7.0%	4.0%	2.0%	3.0%	16.0%	71.2%
P 230A	-	-	-	-	-	-	-	-
S 235	-	-	-	-	-	-	-	-
S 236	-	-	-	-	-	-	-	-
S 237	-	-	-	-	-	-	-	-
S 238	80.3%	-	4.0%	3.0%	2.0%	2.0%	11.0%	69.3%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
P 240	-	-	-	-	-	-	-	-
S 241	-	-	-	-	-	-	-	-
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
S 243	-	-	-	-	-	-	-	-
S 244	-	-	-	-	-	-	-	-
S 246	-	-	-	-	-	-	-	-
S 247	-	-	-	-	-	-	-	-
P 252	-	-	-	-	-	-	-	-
P 256	-	-	-	-	-	-	-	-
P 259	-	-	-	-	-	-	-	-
S 283	-	-	-	-	-	-	-	-
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
S 286	-	-	-	-	-	-	-	-
P 287	73.0%	-	7.0%	4.0%	2.0%	2.0%	15.0%	58.0%
S 288	-	-	-	-	-	-	-	-

TABLE B-7 EXISTING DOMESTIC HOT WATER HEATING EQUIPMENT EFFICIENCIES SERVING EEAP BUILDINGS

Fac No.	DHW Plant Efficiency							
	Firing Eff	Auxilliar	Radiant	Convection	Shut-Down	General	Plant Losses	Net Eff
S 290	70.4%	-	8.0%	4.0%	2.0%	3.0%	17.0%	53.4%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
S 291	-	-	-	-	-	-	-	-
P 295	77.7%	-	8.0%	5.0%	2.0%	3.0%	18.0%	59.7%
P 301	-	-	-	-	-	-	-	-
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
P 642	75.2%	-	7.0%	4.0%	2.0%	3.0%	16.0%	59.2%
S 2201	-	-	-	-	-	-	-	-

TABLE B-8 BASELINE DOMESTIC HOT WATER ENERGY USE CALCULATIONS

Fac No.	PN	Actual Temp Deg F	DWH: Baseline Energy Use Gal/Capita-Day Normal	Cooking	Lo-Flow Fittings	55 Degree F CW Temp Adjusted GPCD's Normal	Cooking	DHW Usage Mil BTU/Yr	Added Losses Mil BTU/Yr Tank	Pipe	Baseline DHW Energy Use Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kWH/Yr
T 6	3	135	40.00	Included	Yes	17.80	Included	12.98	3.1	9.5	-	43.30	-
P 41A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 41B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 42A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 42B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 43A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 43B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 44A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 44B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 45A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 45B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 46	4	145	40.00	Included	Yes	17.80	Included	18.39	1.5	2.4	-	34.57	-
P 47	4	145	40.00	Included	Yes	17.80	Included	18.39	1.5	2.4	-	34.57	-
P 51A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 51B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 52A	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 52B	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 53	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 54	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 55	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 56	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 57	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 58	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 59	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
P 60	4	140	40.00	Included	Yes	17.80	Included	18.39	1.4	2.4	-	32.63	-
S 79	2	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 80	60	135	0.50	3.33	No	0.50	3.33	34.92	5.1	8.9	-	-	20,692
P 81	350	135	0.50	3.33	No	0.50	3.33	87.31	5.2	1.3	-	-	43,067
P 101	17	160	0.25	3.33	No	0.25	3.33	15.72	5.2	27.1	-	111.85	-
	9	140	2.00	3.33	No	2.00	3.33	7.29	3.3	1.0	-	29.87	-
	10	140	30.00	0.00	Yes	14.93	0.00	22.68	5.6	9.3	-	101.48	-
	9	140	40.00	Included	Yes	17.80	Included	41.39	2.4	19.2	-	110.91	-
P 116	2	120	5.00	0.00	No	5.00	0.00	1.52	0.4	0.3	-	-	826
	8												-
T 120	7	110	2.00	0.00	No	2.00	0.00	2.13	3.9	10.8	-	28.34	-
	7	140	30.00	3.33	No	30.00	3.33	60.28	6.5	16.8	-	151.49	-
	-												-

TABLE B-8 BASELINE DOMESTIC HOT WATER ENERGY USE CALCULATIONS

Fac		Actual	DWH: Baseline Energy Use			55 Degree F CW Temp			Added Losses		Baseline DHW Energy Use		
No.	PN	Temp	Gal/Capita-Day		Lo-Flow	Adjusted GPCD's		DHW Usage	Mil BTU/Yr		Fuel Oil	Propane	Electric
		Deg F	Normal	Cooking	Fittings	Normal	Cooking	Mil BTU/Yr	Tank	Pipe	Mil BTU/Yr	Mil BTU/Yr	kWH/Yr
T 121	30	121	0.50	3.33	No	0.50	3.33	12.47	0.6	6.2	-	45.13	-
	-	142	5.00	0.00	No	5.00	0.00	5.43	0.6	0.3	-	-	8,599
T 124	4	160	40.00	Included	No	40.00	Included	41.34	1.5	6.6	-	54.20	-
T 127	10	128	30.00	0.00	Yes	14.93	0.00	22.68	5.5	33.4	-	126.91	-
P 128	80	140	30.00	3.33	Yes	14.93	3.33	377.29	2.4	49.8	-	680.12	-
T 131	4	135	40.00	Included	No	40.00	Included	41.34	3.1	6.9	-	46.80	-
S 144	Not	NA	0.50	3.33	No	0.50	3.33	0.00	0.0	0.0	-	0.00	-
S 146	5	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
T 149	4	135	40.00	Included	No	40.00	Included	38.90	3.1	6.7	-	46.80	-
T 156	3	140	5.00	0.00	No	5.00	0.00	1.63	0.6	0.0	-	-	979
	0												-
T 158	0	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
T 161	12	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
T 162	11	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
T 163	NA	-	-	-	NA	-	-	0.00	0.0	0.0	-	-	-
T 164	NA	-	-	-	NA	-	-	0.00	0.0	0.0	-	-	-
T 165	NA	-	-	-	NA	-	-	0.00	0.0	0.0	-	-	-
T 166	NA	-	-	-	NA	-	-	0.00	0.0	0.0	-	-	-
T 167	NA	-	-	-	NA	-	-	0.00	0.0	0.0	-	-	-
S 168	Not	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
T 172	-	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 177	4	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 178	43	110	8.00	3.33	Yes	2.00	3.33	24.88	0.7	11.6	-	56.66	-
S 182	25	110	0.50	3.33	No	0.50	3.33	10.39	0.3	0.4	-	-	3,585
S 186	3	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 190	10	125	0.50	3.33	Yes	0.35	3.33	5.59	1.3	0.1	-	-	2,726
S 197	5	125	2.00	0.00	No	2.00	0.00	1.09	1.3	0.3	-	-	931
	5												-
S 198	2	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 205	90	140	2.00	0.00	Yes	1.10	0.00	10.75	0.0	42.4	84.57	-	-
P 205A	10	135	2.00	0.00	Yes	1.10	0.00	1.19	0.0	0.2	-	-	647
P 206	563	140	0.25	3.33	Yes	0.18	3.33	509.80	57.8	74.0	905.84	-	-
	563	180	0.00	3.33	No	0.00	2.00	0.00	0.0		-	-	-
P 207	80	145	30.00	0.00	Yes	14.93	0.00	181.45	12.9	55.5	553.26	-	-
P 207A	10	130	2.00	0.00	Yes	1.10	0.00	1.19	0.6	0.2	-	-	776
P 208	90	140	30.00	0.00	Yes	14.93	0.00	204.13	12.9	55.5	575.93	-	-
P 208A	10	140	2.00	0.00	Yes	1.10	0.00	1.19	0.8	0.2	-	-	909

TABLE B-8 BASELINE DOMESTIC HOT WATER ENERGY USE CALCULATIONS

Fac		Actual	DWH: Baseline Energy Use			55 Degree F CW Temp			Added Losses		Baseline DHW Energy Use		
No.	PN	Temp	Gal/Capita-Day		Lo-Flow	Adjusted GPCD's		DHW Usage	Mil BTU/Yr		Fuel Oil	Propane	Electric
		Deg F	Normal	Cooking	Fittings	Normal	Cooking	Mil BTU/Yr	Tank	Pipe	Mil BTU/Yr	Mil BTU/Yr	kWH/Yr
P 209	180	145	2.00	3.33	Yes	1.10	3.33	121.18	1.2	5.4	-	-	67,115
P 210	35	140	120.00	3.33	Yes	120.00	3.33	1,115.18	6.5	52.2	2,023.92	-	-
P 211	NA	NA	0.50	3.33	No	0.50	3.33	0.00	0.0	0.0	-	0.00	-
P 212	9	130	0.50	3.33	Yes	0.35	3.33	5.03	1.7	3.6	-	22.94	-
P 219	20	120	12.00	3.33	Yes	4.58	3.33	24.03	4.0	9.5	-	70.07	-
P 229	28	130	30.00	0.00	Yes	14.93	0.00	63.51	10.8	46.5	212.14	-	-
P 229A	10	120	2.00	0.00	Yes	1.10	0.00	1.19	0.6	0.2	-	-	688
P 230	80	129	30.00	0.00	Yes	14.93	0.00	181.45	10.8	45.9	456.96	-	-
P 230A	10	130	2.00	0.00	Yes	1.10	0.00	1.19	0.6	0.2	-	-	794
S 235	NA	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 236	NA	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 237	NA	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 238	50	122	2.00	0.00	Yes	1.10	0.00	5.97	5.6	19.3	-	47.54	-
	0	160	50.00	0.00	No	50.00	0.00	(10.96)	0	16.7	-	35.60	-
P 240	12	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 241	15	120	2.00	0.00	NA	2.00	0.00	3.26	0.6	5.4	-	-	3,009
	0												-
	0												-
S 243	12	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 244	12	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 246	12	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 247	12	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 252	12	120	5.00	0.00	No	5.00	0.00	6.51	2.9	1.0	-	-	3,715
P 256	4	135	5.00	0.00	No	5.00	0.00	2.17	13.4	0.1	-	-	4,980
P 259	12	125	5.00	0.00	No	5.00	0.00	6.51	1.2	1.0	-	-	3,440
S 283	1	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
	0												-
S 286	NA	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 287	15	140	2.00	3.33	Yes	1.10	3.33	10.10	3.3	10.9	-	61.52	-
S 288	NA	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
S 290	15	135	5.00	0.00	No	5.00	0.00	8.14	6.1	14.2	-	62.38	-
	0												-
S 291	6	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
P 295	114	128	30.00	0.00	Yes	14.93	0.00	258.57	12.8	98.8	-	819.77	-
P 301	20	132	2.00	0.00	Yes	1.10	0.00	3.34	0.5	0.6	-	-	1,898
	0												-
	0												-

TABLE B-8 BASELINE DOMESTIC HOT WATER ENERGY USE CALCULATIONS

Fac No.	PN	Actual Temp Deg F	DWH: Baseline Energy Use			55 Degree F CW Temp			Added Losses Mil BTU/Yr		Baseline DHW Energy Use		
			Gal/Capita-Day Normal	Gal/Capita-Day Cooking	Lo-Flow Fittings	Adjusted GPCD's Normal	Adjusted GPCD's Cooking	DHW Usage Mil BTU/Yr	Tank	Pipe	Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kWH/Yr
P 642	25	130	24.00	0.00	Yes	8.93	0.00	33.91	2.5	15.6	-	116.70	-
S 2201	1	-	0.00	0.00	NA	0.00	0.00	0.00	0.0	0.0	-	-	-
Totals			SUBTOTALS, Million BTU / Year (MW-Hr/Yr)					4,061	265	860	4,813	3,657	169,376
Gallons			SUBTOTALS, Gallons / Year								34,698	39,738	

TABLE B-9 BUILDING BASELINE LIGHTING ENERGY USE SUMMARY

Fac No.	Installation Name	Area (SF)	1 = BLDG USAGE FACTORE	USAGE FACTOR %	Default Density Watts/SF	ON-HOUR PER YEAR	CONNECTE LOAD Watts	Baseline Energy kWH/Yr
T 6	Family Housing NCO & Enl	1,090	1	25%	1.5	874	1,635	2,381
P 41A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 41B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 42A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 42B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 43A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 43B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 44A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 44B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 45A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 45B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 46	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 47	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 51A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 51B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 52A	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 52B	Family Housing NCO & Enl	1,937	1	25%	1.5	874	2,906	4,230
P 53	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 54	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 55	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 56	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 57	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 58	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 59	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
P 60	Family Housing CG & WO	2,089	1	25%	1.5	874	3,134	4,562
S 79	Post Office, Main	1,000		25%	2.5	374	1,224	764
P 80	Exchange, Main Retail	9,093		25%	2.5	437	13,921	10,134
P 81	Theater with Dressing Rm's	6,719		25%	2.5	164	8,430	2,301
P 101	Open Din Cons (Hacienda)	6,171	1	25%	2.5	328	15,428	8,423
	Club (Bar)	3046		25%	2.5			0
	Hacienda, East Rooms	4,721		25%	2.0			0
	Hacienda, West Rooms	8,273		25%	1.5			0
P 116	Exchange Service Station	1,126		25%	1.0	710	2,680	3,170
	(Non-shop areas)	662		25%	2.5			0
T 120	Fire Station - Office	3,636		90%	2.5	4,659	28,365	148,678
	Fire Station - Dorm	2,653		60%	2.0			0
	Fire Station - Garage	4,949		90%	1.0			0
T 121	Bowling Center	4,952		90%	2.5	2,912	7,204	23,600
		628		90%	1.0			0
T 124	Family Housing LC & MJ	2,001	1	25%	1.5	874	3,002	4,370
T 127	Officers Quarters Military	2,250		60%	2.0	3,203	2,560	8,946
P 128	Officers Quarters Military	20,196	1	60%	2.0	3,203	40,392	141,146
T 131	Family Housing CG & WO	998	1	25%	1.5	874	1,497	2,180
S 144	Gymnasium	7,172		80%	2.5	0	2,841	0
S 146	FE Facility	4,042		90%	1.0	1,872	2,459	5,179
T 149	Family Housing NCO & Enl	1,196		25%	1.5	874	772	1,124
T 156	FE Facility - Shop	1,753		90%	1.0	1,872	4,362	9,186
	FE Facility - Office	497		90%	2.5			0
T 158	Vehicle Storage	1,859		90%	1.0	0	666	0
T 161	Admin General Purpose	2,250		90%	2.5	1,872	4,104	8,643
T 162	Elec Maint. Shop	2,250		90%	1.0	1,872	2,404	5,063
T 163	Officers Quarters Military	2,250		60%	2.0	1,287	2,404	3,375
T 164	Admin General Purpose	2,250		90%	2.5	1,872	2,404	5,063
T 165	Admin General Purpose	2,250		90%	2.5	1,872	2,404	5,063
T 166	Officers Quarters Military	2,250		60%	2.0	1,287	2,404	3,375
T 167	Officers Quarters Military	2,250		60%	2.0	1,287	2,404	3,375
S 168	General Purp Warehouse	6,560		90%	1.0	0	1,374	0
T 172	Cold Storage Warehouse	800		90%	1.0			0
P 177	Technical Library	3,599		90%	2.5	1,872	7,620	16,048
P 178	Child Development Cntr	3,599	1	85%	2.0	2,340	7,198	19,089

TABLE B-9 BUILDING BASELINE LIGHTING ENERGY USE SUMMARY

Fac No.	Installation Name	Area (SF)	1 = BLDG USAGE FACTORE	USAGE FACTOR %	Default Density Watts/SF	ON-HOUR PER YEAR	CONNECTE LOAD Watts	Baseline Energy kWH/Yr
S 182	Commissary	3,000		95%	3.0	1,664	12,672	25,040
S 186	Sup Svc Admin Bldg	1,920		90%	2.5	1,872	5,328	11,221
P 190	Post Chapel	2,720		20%	0.3	473	3,437	3,253
S 197	Admin Bldg R&D - Office	2,100		90%	2.5	1,872	16,885	35,560
	Admin Bldg R&D - Electronics	6,062		90%	1.0			0
S 198	General Inst Bldg	1,090		90%	2.5	1,664	2,116	3,961
P 205	Admin General Purpose	35,820		90%	2.5	3,328	24,262	90,837
P 205A	Company HQ Building	5,161	1	90%	2.5	2,080	12,903	30,192
P 206	Enlisted Pers Dining Fac	16,768		60%	2.5	4,368	8,208	43,023
	Kitchen Area - Scullery							0
P 207	Enl Barracks w/o Dining	35,820		60%	2.0	3,203	24,062	84,082
P 207A	Company HQ Building	5,161	1	90%	2.5	2,080	12,903	30,192
P 208	Enl Barracks w/o Dining	35,820		60%	2.0	3,203	24,262	84,781
P 208A	Company HQ Building	5,161	1	90%	2.5	2,080	12,903	30,192
P 209	AAFES Snack Bar	3,320		50%	2.5	1,092	4,158	7,568
P 210	Hlth/Dntl Clinic w/ Beds	10,973		95%	2.0	6,989	15,192	126,081
P 211	Outdoor Swimming Pool	-		80%	2.5			0
P 212	Gymnasium	8,907		80%	2.5	2,803	10,479	33,566
P 219	Physical Fitness Center	3,212	1	80%	2.5	2,402	8,030	25,722
P 229	Enl Barracks w/o Dining	40,915		60%	2.0	3,203	24,262	84,781
P 229A	Company HQ Building	5,161	1	90%	2.5	2,080	12,903	30,192
P 230	Enl Barracks w/o Dining	35,820		60%	2.0	3,203	24,262	84,781
P 230A	Company HQ Building	5,161	1	90%	2.5	2,080	12,903	30,192
S 235	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 236	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 237	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 238	Sig Photo Lab	14,548		90%	2.5	2,080	22,304	52,191
P 240	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 241	GM Facility	10,000		90%	2.5	2,080	18,004	42,129
S 243	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 244	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 246	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
S 247	Admin General Purpose	3,000		90%	2.5	2,080	4,608	10,783
P 252	Vehicle Maint Shop DS	12,299	1	90%	1.0	2,080	12,299	28,780
P 256	Vehicle Maint Shop ORG	5,294	1	90%	1.0	2,080	5,294	12,388
P 259	Vehicle Maint Shop ORG	13,667	1	90%	1.0	2,080	13,667	31,981
S 283	FE Maintenance Shop	4,000		90%	1.0	2,080	3,894	9,112
S 286	Admin General Purpose	3,000		90%	2.5	1,872	4,608	9,704
P 287	Recreation Building	5,584		50%	2.5	983	9,526	15,604
S 288	General Purpose Warehouse	3,000		90%	1.0	1,872	4,608	9,704
S 290	Electron Equip Facility	14,856		90%	1.0	1,872	18,648	39,273
S 291	Cont Humid Warehouse	7,400	1	90%	1.0	1,872	7,400	15,584
P 295	Enl Barracks w/o Dining	46,593		90%	2.0	4,659	22,500	117,936
P 301	ADP Building	10,800		90%	2.5	1,872	21,844	46,003
P 642	Detached Latrine/Shower	995		90%	1.0	1,213	720	983
S 2201	Control Tower - Range SPT	891		90%	2.5	0	288	0
Building Totals							718,765	1,958,377
Exterior/Street Lighting								197,190
Total Lighting								2,155,567

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TABLE B-10 PROCESS ELECTRIC ENERGY USE SUMMARY

Fac No.	Installation Name	Area (SF)	Facility Utilization Factors				PROCESS ENERGY USAGE		
			Usage Code	PN	Days /Week	Meals /Day	Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking & Other Prop Mil BTU/Yr
T 6	Family Housing NCO & Enl	1,090	10	3	7	15	5,900	Included	10.5
P 41A	Family Housing NCO & Enl	1,397	10	4	7	12	5,900	Included	10.5
P 41B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 42A	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 42B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 43A	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 43B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 44A	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 44B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 45A	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 45B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 46	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 47	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 51A	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 51B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 52A	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 52B	Family Housing NCO & Enl	1,937	10	4	7	12	5,900	Included	10.5
P 53	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 54	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 55	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 56	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 57	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 58	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 59	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
P 60	Family Housing CG & WO	2,089	10	4	7	12	5,900	Included	10.5
S 79	Post Office, Main	1,000	8	2	6	0	1,700	0	-
P 80	Exchange, Main Retail	9,093	8	60	7	0	112,084	0	-
P 81	Theater with Dressing Rm's	6,719	6	350	3	-	1,058	0	-
P 101	Open Din Cons (Hacienda)	6,171	7	17	7	120	0	39,420	-
	Club (Bar)	3046	9	9	7	10	6,092	5,475	-
	Hacienda, East Rooms	4,721	3	10	7	-	4,000	-	-
	Hacienda, West Rooms	8,273	10	9	7	9	5,900	Included	10.5
P 116	Exchange Service Station	1,126	2.01	2	7	0	481	-	-
	(Non-shop areas)	662	8	8	7	0	1,126	0	-
T 120	Fire Station - Office	3,636	1	7	7	-	3,291	-	-
	Fire Station - Dorm	2,653	4	7	7	21	2,800	6,899	-
	Fire Station - Garage	4,949	2.02	-	0	0	134	-	-
T 121	Bowling Center	4,952	5	30	5	10	4,482	5,475	-
		628	2.01	-	5	-	13,144	-	-
T 124	Family Housing LC & MJ	2,001	10	4	7	12	5,900	Included	10.5
T 127	Officers Quarters Military	2,250	3	10	7	0	4,000	-	-
P 128	Officers Quarters Military	20,196	4	80	7	160	32,000	52,560	-
T 131	Family Housing CG & WO	998	10	4	7	12	5,900	Included	10.5
S 144	Gymnasium	7,172	5	No	0	0	6,491	0	-
S 146	FE Facility	4,042	2.01	5	5	0	1,727	-	-
T 149	Family Housing NCO & Enl	1,196	10	4	7	12	5,900	Included	10.5
T 156	FE Facility - Shop	1,753	2.01	3	5	0	749	-	-
	FE Facility - Office	497	1	0	0	-	450	-	-
T 158	Vehicle Storage	1,859	2.02	0	0	0	50	-	-
T 161	Admin General Purpose	2,250	1	12	5	0	2,036	-	-
T 162	Elec Maint. Shop	2,250	2.01	11	5	0	961	-	-
T 163	Officers Quarters Military	2,250	3	NA	5	NA	NA	-	-

TABLE B-10 PROCESS ELECTRIC ENERGY USE SUMMARY

Fac No.	Installation Name	Area (SF)	Facility Utilization Factors: Usage Code	PN	Days /Week	Meals /Day	PROCESS ENERGY USAGE: Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking & Other Prop Mil BTU/Yr
T 164	Admin General Purpose	2,250	1	NA	5	NA	2,036	-	-
T 165	Admin General Purpose	2,250	1	NA	5	NA	2,036	-	-
T 166	Officers Quarters Military	2,250	3	NA	5	NA	NA	-	-
T 167	Officers Quarters Military	2,250	3	NA	5	NA	NA	-	-
S 168	General Purp Warehouse	6,560	2.02	Not in Use			178	-	-
T 172	Cold Storage Warehouse	800	2.02	-	7	0	22	-	-
P 177	Technical Library	3,599	1	4	5	0	3,257	-	-
P 178	Child Development Cntr	3,599	11.3	43	5	31	272	10,184	-
S 182	Commissary	3,000	8.1	25	5	0	172,782	0	-
S 186	Sup Svc Admin Bldg	1,920	1	3	5	0	1,738	-	-
P 190	Post Chapel	2,720	6	10	7	3	1,058	1,643	-
S 197	Admin Bldg R&D - Office	2,100	1	5	5	0	1,901	-	-
	Admin Bldg R&D - Electronics	6,062	2.01	5	5	0	2,589	-	-
S 198	General Inst Bldg	1,090	1	2	4	0	986	-	-
P 205	Admin General Purpose	35,820	1	90	5	-	32,417	-	-
P 205A	Company HQ Building	5,161	1	10	5	-	4,671	-	-
P 206	Enlisted Pers Dining Fac	16,768	7	563	7	563	0	184,946	-
	Kitchen Area - Scullery		7	563	7	563	0	-	-
P 207	Enl Barracks w/o Dining	35,820	3	80	7	0	32,000	-	-
P 207A	Company HQ Building	5,161	1	10	5	0	4,671	-	-
P 208	Enl Barracks w/o Dining	35,820	3	90	7	0	36,000	-	-
P 208A	Company HQ Building	5,161	1	10	5	0	4,671	-	-
P 209	AAFES Snack Bar	3,320	9	180	7	180	6,640	98,550	-
P 210	Hlth/Dntl Clinic w/ Beds	10,973	12.1	35	7	9	37,308	2,957	-
P 211	Outdoor Swimming Pool	-	5	NA	7 D/W	0	0	0	-
P 212	Gymnasium	8,907	5	9	7	0	8,061	0	-
P 219	Physical Fitness Center	3,212	5.1	20	7	0	2,907	-	-
P 229	Enl Barracks w/o Dining	40,915	3	28	7	0	11,200	-	-
P 229A	Company HQ Building	5,161	1	10	5	0	4,671	-	-
P 230	Enl Barracks w/o Dining	35,820	3	80	7	0	32,000	-	-
P 230A	Company HQ Building	5,161	1	10	5	0	4,671	-	-
S 235	Admin General Purpose	3,000	1	NA	5	0	2,715	-	-
S 236	Admin General Purpose	3,000	1	NA	5	0	2,715	-	-
S 237	Admin General Purpose	3,000	1	NA	5	0	2,715	-	-
S 238	Sig Photo Lab	14,548	1	50	5	0	13,166	-	-
	Process						16,425		-
P 240	Admin General Purpose	3,000	1	12	5	0	2,715	0	-
S 241	GM Facility	10,000	1	15	5	0	9,050	0	-
									-
									-
S 243	Admin General Purpose	3,000	1	12	5	0	2,715	0	-
S 244	Admin General Purpose	3,000	1	12	5	0	2,715	0	-
S 246	Admin General Purpose	3,000	1	12	5	0	2,715	0	-
S 247	Admin General Purpose	3,000	1	12	5	0	2,715	0	-
P 252	Vehicle Maint Shop DS	12,299	2.01	12	5	0	5,254	0	-
P 256	Vehicle Maint Shop ORG	5,294	2.01	4	5	0	2,261	0	-
P 259	Vehicle Maint Shop ORG	13,667	2.01	12	5	0	5,838	0	-
S 283	FE Maintenance Shop	4,000	2.01	1	5	0	1,709	0	-
									-
S 286	Admin General Purpose	3,000	1	NA	5	0	2,715	0	-
P 287	Recreation Building	5,584	9	15	7	-	11,168	0	-
S 288	General Purpose Warehouse	3,000	2.02	NA	5	0	81	0	-

TABLE B-10 PROCESS ELECTRIC ENERGY USE SUMMARY

Fac No.	Installation Name	Area (SF)	Facility Utilization Factors				PROCESS ENERGY USAGE		
			Usage Code	PN	Days /Week	Meals /Day	Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking & Other Prop Mil BTU/Yr
S 290	**Electron Equip Facility**	**14,856**	2.01	15	5	0	6,346	0	- -
S 291	**Cont Humid Warehouse**	**7,400**	2.01	6	5	0	3,161	0	-
P 295	**Enl Barracks w/o Dining**	**46,593**	3	114	7	0	45,600	0	-
P 301	**ADP Building**	**10,800**	1	20	7	0	9,774 495,272	0	- - -
P 642	**Detached Latrine/Shower**	**995**	3.1	25	7	0	0	0	-
S 2201	**Control Tower - Range SPT**	**891**	1	1	Few	0	806	0	-
Totals							1,431,044	408,107	304.5

TABLE B-11 ESTIMATED ENERGY USE VERSUS RECORDED ENERGY USE

Description	Amount	Units
FY91 Heating Fuel Oil Deliveries	24,648	Mil BTU/Yr
Baseline Simulated Fuel Oil Use	21,797	Mil BTU/Yr
Difference for Heating Fuel Oil	-11.6%	
FY91 Adjusted Propane Deliveries	20,963	Mil BTU/Yr
Baseline Simulated Propane Use	18,337	Mil BTU/Yr
Difference for Propane (See Note)	-12.5%	
FY91 Electricity Usage		
Main Garrison Account	10,738,601	kWH/Yr
Water Pump Account	136,240	kWH/Yr
T376 Account	11,815	kWH/Yr
T6 Account	11,731	kWH/Yr
Total FY91 Electricity Use	10,898,387	kWH/Yr
Baseline Simulated Electricity Use	9,893,823	kWH/Yr
Difference for Electricity	-9.2%	

Note: Propane delivery records were only made available for the period between 6 November 1991 and 31 August 1992. These delivery records were normalized to a full year using the ratio of 65 Degree F based Heating Degree Hours in the period of record.

TABLE B-12

LIGHTING ENERGY USE CALCULATION METHODOLOGY

Function Code	Description of Usage	Usage Factor	Lighting Watts/SF
1	Offices	90%	2.5
2	Shops and Warehouses	90%	1.0
2.1	Commercial Laundries	90%	2.0
3	Barracks & Quarters w/o Dining	60%	2.0
3.1	Detached Latrine with Bathing	90%	1.0
4	Barracks & Quarters with Dining	60%	2.0
5	Recreation & Gyms w/o Bathing	80%	2.5
5.1	Recreation & Gyms with Bathing	80%	2.5
6	Theaters / Community Facilities	20%	2.5
7	Dining Facilities, all uses	60%	2.5
8	Base Exchanges & Stores	95%	2.5
8.1	Commissaries	95%	3.0
9	Clubs, Officers, NCO, Enl PN	50%	2.5
10	Family Housing	25%	1.5
11.1	Schools w/o Bathing	85%	3.0
11.2	Schools with Bathing	85%	3.0
11.3	Child Development Centers	85%	2.0
12	Medical Facilities, Clinics	95%	2.0
12.1	Medical Facilities, Hospitals	95%	2.0
13	Multiple Usage Buildings	95%	2.0

LIGHTING ENERGY USE CALCULATIONS

Lighting energy use for EEAP buildings at Fort Hunter Liggett is determined based on a combination of field observations, design data and experience in similar projects. Baseline lighting energy use is calculated as follows:

Buildings with complete lighting system take-offs tabulated:

The building schedule is evaluated to determine schedule on-time hours per year. The watts per fixture (listed separately by fixture type) are multiplied by the sheduled on-hours per year and a utilization (diversity) factor. Electrical energy use is recorded in kWH/Yr. The building connected lighting load is determined by summing the connected loads of all tabulated fixtures.

Buildings with only candidate retrofit lighting fistures tabulated:

Several building lighting system tabulations are limited to listing only those fixtures which are candidates for retrofit. For these buildings, lighting energy usage and connected loads are determined based on lighting densities and utilization factors normally associated with the building's function.

TABLE B-13
PROCESS ELECTRIC ENERGY USE SUMMARY

PROCESS ENERGY USE FACTORS

Usage Code	Description	Process Electric Use kWH/Unit-Yr	Unit	Cooking kWH/Meal	Propane Mil BTU/Yr
1	Offices & Administratio	0.91	SF	-	-
2.01	Shops & Warehouses:	0.43	SF	-	-
2.02	Shops & Warehouses:	0.03	SF	-	-
2.10	Laundry - Commercial	Separate Calcs.		-	-
3	Barracks & Quarters w/	400	PN	-	-
3.1	Detached Latrine Buildi	0	NA	-	-
4	Barracks & Quarters wi	400	PN	0.90	-
5	Recreation Facilities	0.91	SF	1.50	-
5.1	Gymnasiums	0.91	SF	-	-
6	Theaters & Assembly F	1,058	Facility	1.50	-
7	Dining Facilities: All El	included with meals		0.90	-
8	Base Exchanges & Sto	1.70	SF	1.50	-
8.1	Commissaries	3.50	SF	1.50	-
9	Clubs: Officers & NCO	2.00	SF	1.50	-
10	Family Housing, Includ	5,900	Facility,	Included	10.5 Mil BTU/Yr
11	Schools	2.30	SF	0.90	-
11.3	Child Development Ce	272	Facility	0.90	-
12	Medical Facilities, Clini	-	-	0.90	-
12.1	Clinics with Beds	3.40	SF	0.90	-

PROCESS ENERGY USAGE FACTORS

Usage Code 1: Offices & Administration

Equipment typically includes: Typewiters, coffee pots, vending machines, some copy machines, microwaves, personal computers and prionters.

Based on equipment loads and diversity of use, a small office (about 5,000 SF or less) without a copy machine or personal computers will consume about 500 kW-Hr/Yr of electric power.

Additional power use for personal computers is esimated at about 150 kW-Hr/Yr per unit [Newsham, G.R., et all, "A Case Study of the Energy Consumption of Desktop Computers", IEEE Publication Number 0- 7803- 0634- 1/92$03.00.] Almost all offices are equipped with personal computers. Each office uses about 200 SF of office-building floor area.

Additional power consumption by microwave ovens is estimated at 275 kW-Hr/Yr assuming an average 750 Watt oven, used a total of 1.5 Hr/Day, 5 Days/Week.

A larger office, equipped with a copy machine is estimated to consume an additional 1,000 kW-Hr/Yr.

Thus, for offices 5,000 SF or smaller, electric use is estimated at:

500	kW-Hr/Yr, plus
150	kW-Hr/Yr per 200 SF @ PC's, and
275	kW-Hr/Yr per 5,000 SF @ microwave ovens
0.91	kW-Hr/Yr-Office SF

DOMESTIC HOT WATER TANK & PIPING HEAT LOSS CALCULATIONS

Piping losses for non circulated and circulated systems are determined in the following calculations:

Losses from Non-Circulated Domestic Hot Water Systems

Losses are experienced only as a result of hot water use. Water initially in the pipes is wasted waiting for hot water to arrive, and hot water in the pipes after the use is completed cools. Thus, each time hot water is used, twice the energy needed to heat the volume of water in piping is lost. Heat loss calculations are based on a number of assumed uses per day (dependant on building type), the volume of water contained in piping systems and the temperature of the water.

Family Housing Buildings:

Average 3/4" pipe, 40 foot run = 0.29 Gallons

Average 4 uses per day per person, thus:

4 PN x 4 uses x .29 Gallons x 2 = 3,413 Gallons/Year
Lost Domestic Hot Water Heat

Stores and Other Community Facilities

Toilets in public access buildings are used by employees and customers. Employees are assumed to have 3 uses per day each and customers are assumed to have one use per 5 customers.

Average 3/4" pipe, 20 foot run = 0.15 Gallons

Average use for employees:

1 PN x 3 uses x .15 Gallons x 2 = 320 Gallons/Employee-Year
Lost Domestic Hot Water Heat

Average Use for Customers:

1 PN x 1/5 uses x .15 Gallons x 2 = 21.3 Gallons/Customer-Year
Lost Domestic Hot Water Heat

Building 6:

Insulation Repairs needed; add to load calculated for Family Housing:

15 LF Pipe 0.75 inch Dia, Bare Pipe

590.00 BTUH/10LF 7.75 Mil BTU/Yr Added Load

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Building 80:

Insulation Repairs needed; add to load calculated for normal use for stores:

15 LF Pipe 0.75 inch Dia, Deteriorated Insulation, same as Bare Pipe

590.00 BTUH/10LF 7.75 Mil BTU/Yr Added Load

Building 101

Dining Area Water Heater: ~75 LF 1 inch pipe; 50 uses per day

3.06 Gallons 160 Deg F 2,683 BTU Lost per Use

33.5 Mil BTU/Yr Load Lost

Added losses will result from A/C System type insulation on about 75 LF of 1 inch dia piping. Recommend it be replaced with proper insulation for exterior hot water piping.

Bar Area Water Heater Piping: ~20 LF 3/4 inch pipe; 20 uses per day

0.46 Gallons 140 Deg F 326 BTU Lost per Use

1.6 Mil BTU/Yr Load Lost

Rooms - East Area Water Heater Piping: ~50 LF 1 inch pipe; 3 uses per day per PN.

2.04 Gallons 140 Deg F 1,448 BTU Lost per Use

1.6 Mil BTU/Yr Load Lost

Rooms - West Area Water Heater Piping: ~112 LF 1 inch pipe; 3 uses per day per PN.

4.57 Gallons 120 Deg F 2,480 BTU Lost per Use

2.7 Mil BTU/Yr Load Lost

35 LF of 3/4 inch Bare pipe should be insulated: losses are based on uses for 3 hours per day

35 LF, 140 Deg F, 100 BTUH/10L = 0.38 Mil BTU/Y

Building 120:

Insulation Repairs needed; add to load calculated for normal use for stores:

15 LF Pipe 0.75 inch Dia, Bare Pipe
25 LF Pipe 0.75 inch Dia, Deteriorated Insulation, same as Bare Pipe

310.00 BTUH/10LF 4.07 Mil BTU/Yr Added Load
60.00 BTUH/10LF 1.31 Mil BTU/Yr Added Load

Total @ 110 Deg F HW Temperature: 5.39 Mil BTU/Yr Added Load

15	LF Pipe	0.75	inch Dia, Bare Pipe	
25	LF Pipe	0.75	inch Dia, Deteriorated Insulation, same as Bare Pipe	
550.00	BTUH/10LF	7.23	Mil BTU/Yr Added Load	
120.00	BTUH/10LF	2.63	Mil BTU/Yr Added Load	

Total @ 140 Deg F HW Temperature: 9.86 Mil BTU/Yr Added Load

Building 121:

Kitchen Area: 50 uses per day, 20 LF 1 inch pipe

0.82 Gallons 121 Deg F 450 BTU Lost per Use

8.2 Mil BTU/Yr Load Lost

Building 124:

Insulation Repairs needed; add to load calculated for normal use:

10 LF Pipe 0.75 inch Dia, Bare Pipe

480.00 BTUH/10LF 4.20 Mil BTU/Yr Added Load

Building 127:

Water Heater Piping: ~50 LF 1 inch pipe; 3 uses per day per PN.

2.04 Gallons 128 Deg F 1,244 BTU Lost per Use

1.4 Mil BTU/Yr Load Lost/PN

Note: Building 127 DHW pipe insulation repairs are needed for 50 LF of 1-inch supply piping.

Additional heat losses from these pipes are:

Supply @ 128 Deg F, 1-inch Pipe	550	BTUH/10LF Bare	90	BTUH/10L
Total Heat Losses			24.09	Mil BTU/Y

Building 131:

Insulation Repairs needed; add to load calculated for normal use:

10 LF Pipe 0.75 inch Dia, Bare Pipe

510.00 BTUH/10LF 4.47 Mil BTU/Yr Added Load

Building 149:

Insulation Repairs needed; add to load calculated for normal use:

10 LF Pipe 0.75 inch Dia, Bare Pipe

510.00 BTUH/10LF 4.47 Mil BTU/Yr Added Load

Building 156:

3	Uses per day/PN,	10	LF Pipe	0.5	inch Dia
0.04	Gallons	0.02	Mil BTU/Yr Added Load		

Building 190:

1	Uses per day/PN,	20	LF Pipe	0.5	inch Dia
0.08	Gallons	0.17	Mil BTU/Yr Added Load		

Building 197:

3	Uses per day/PN,	30	LF Pipe	1	inch Dia
0.49	Gallons	0.72	Mil BTU/Yr Added Load		

Buildings 205A, 207A, 208A, 229A and 230A:

3	Uses per day/PN,	15	LF Pipe	0.75	inch Dia
		10	LF Pipe	0.5	inch Dia
0.18	Gallons				

Bldg	PN	Temp		
205A	10	135	0.30	Mil BTU/Yr Added Load
207A	10	130	0.28	Mil BTU/Yr Added Load
208A	10	140	0.32	Mil BTU/Yr Added Load
229A	10	120	0.24	Mil BTU/Yr Added Load
230A	10	130	0.28	Mil BTU/Yr Added Load

Building 209:

0.2	Uses per PN-Day	60	LF Pipe	1	inch Dia
0.98	Gallons	19.39	Mil BTU/Yr Added Load		

Building 212:

1	Uses per PN-Day	20	LF Pipe	0.75	inch Dia
0.18	Gallons	0.36	Mil BTU/Yr Added Load		

Insulation Repairs needed:

8	LF Pipe	0.75	inch Dia, Bare Pipe
470.00	BTUH/10LF	3.29	Mil BTU/Yr Added Load

Total Present Load Losses: 3.66 Mil BTU/Yr Added Load

Building 219:

1	Uses per PN-Day	50	LF Pipe	1	inch Dia
0.82	Gallons	3.24	Mil BTU/Yr Added Load		

Insulation Repairs needed:

10	LF Pipe	2	inch Dia, Bare Pipe
800.00	BTUH/10LF	7.01	Mil BTU/Yr Added Load

Total Present Load Losses: 10.25 Mil BTU/Yr Added Load

Building 241:

3	Uses per PN-Day	20	LF Pipe	0.5	inch Dia
0.08	Gallons	0.73	Mil BTU/Yr Added Load		

Insulation Repairs needed:

20	LF Pipe	0.5	inch Dia, Bare Pipe
310.00	BTUH/10LF	5.43	Mil BTU/Yr Added Load

Total Present Load Losses: 6.16 Mil BTU/Yr Added Load

Building 252:

3	Uses per PN-Day	20	LF Pipe	0.75	inch Dia
0.18	Gallons	1.31	Mil BTU/Yr Added Load		

Building 256:

3	Uses per PN-Day	10	LF Pipe	0.5	inch Dia
0.04	Gallons	0.12	Mil BTU/Yr Added Load		

Building 259:

3	Uses per PN-Day	20	LF Pipe	0.75	inch Dia
0.18	Gallons	1.41	Mil BTU/Yr Added Load		

Building 287:

3	Uses per PN-Day	88	LF Pipe	0.75	inch Dia
3	Uses per PN-Day	20	LF Pipe	0.5	inch Dia

0.81 Gallons — 9.44 Mil BTU/Yr Added Load
0.08 Gallons — 0.95 Mil BTU/Yr Added Load

Insulation Repairs needed:

10 LF Pipe 0.75 inch Dia, Bare Pipe

550.00 BTUH/10LF — 4.82 Mil BTU/Yr Added Load

Total Present Load Losses: 15.21 Mil BTU/Yr Added Load

Building 301:

3 Uses per PN-Day — 15 LF Pipe — 0.5 inch Dia

0.06 Gallons — 0.86 Mil BTU/Yr Added Load

Losses from Circulating Domestic Hot Water Systems

Heat loss calculations are based on takeoffs from building plans, field inspections of piping condition and DHW temperature. Heat losses are determined from Figure 8-47, Architects and Engineers Guide to Energy Conservation in Existing Buildings, February 1980, U.S. DOE.

Building 120

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
1/2	90	1	140	87	6.9
3/4	90	1	140	88	6.9

Building 128

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
3	20	1	140	363	6.4
2	90	1	140	175	13.8
1-1/2	118	1	140	138	14.2
1	88	1	140	100	7.7
3/4	270	1	120	75	17.7

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (140 - 80) / (140 - 68) = 0.83

Building 178

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
3/4	200	1	110	48	8.3
1/2	200	1	90	45	7.9

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (110 - 80) / (110 - 68) = 0.71

Buildings 205, 207 & 208

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
1	180	1	140	100	15.8
3/4	180	1	140	75	11.8
1/2	90	1	140	87	6.9
3/4	150	1	120	75	9.9
1/2	150	1	120	50	6.6

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (140 - 80) / (140 - 68) = 0.83

Note: Buildings 207 and 208 DHW pipe insulation repairs are needed for 10 LF of 2-inch supply and 3/4 inch return piping.

Additional heat losses from these pipes are:				
Supply @ 140 Deg F, 2-inch Pipe	1,110	BTUH/10LF Bare	180	BTUH/10LF 1-inch In
Return @ 120 Deg F, 3/4-inch Pipe	390	BTUH/10LF Bare	75	BTUH/10LF 1-inch In
Total Heat Losses	1,500	BTUH/10LF Bare	13.14	Mil BTU/Yr Added Lo

Building 229

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
1	180	1	130	90	14.2
3/4	180	1	130	80	12.6
1/2	90	1	130	60	4.7
3/4	150	1	110	48	6.3
1/2	150	1	110	47	6.2

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (130 - 80) / (130 - 68) = 0.81

Note: Building 229 DHW pipe insulation repairs are needed for 10 LF of 2-inch supply and 3/4 inch return piping.

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Additional heat losses from these pipes are:				
Supply @ 130 Deg F, 2-inch Pipe	940	BTUH/10LF Bare	170	BTUH/10LF 1-inch In
Return @ 110 Deg F, 3/4-inch Pipe	320	BTUH/10LF Bare	48	BTUH/10LF 1-inch In
Total Heat Losses	1,260	BTUH/10LF Bare	11.04	Mil BTU/Yr Added Lo

Building 230

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
1	180	1	129	89	14.0
3/4	180	1	129	79	12.5
1/2	90	1	129	59	4.7
3/4	150	1	109	47	6.2
1/2	150	1	109	46	6.0

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (129 - 80) / (129 - 68) = 0.80

Note: Building 230 DHW pipe insulation repairs are needed for 10 LF of 2-inch supply and 3/4 inch return piping.

Additional heat losses from these pipes are:				
Supply @ 129 Deg F, 2-inch Pipe	939	BTUH/10LF Bare	169	BTUH/10LF 1-inch In
Return @ 109 Deg F, 3/4-inch Pipe	319	BTUH/10LF Bare	47	BTUH/10LF 1-inch In
Total Heat Losses	1,258	BTUH/10LF Bare	11.02	Mil BTU/Yr Added Lo

Building 206

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
2	300	1	140	175	46.0
1-1/2	25	1	140	138	3.0
1	30	1	140	100	2.6
3/4	170	1	140	88	13.1
2	250	1	120	110	24.1

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (140 - 80) / (140 - 68) = 0.83

Building 210

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
2	10	1	140	175	1.5
1-1/2	66	1	140	138	8.0
1-1/4	45	1	140	115	4.5
1	69	1	140	100	6.0
3/4	204	1	140	88	15.7
1/2	195	1	120	87	14.9
1/2	273	1	120	50	12.0

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (140 - 80) / (140 - 68) = 0.83

Building 238

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
1-1/2	30	1" HTHW	160	185	4.9
1-1/4	40	1" HTHW	160	150	5.3
1	34	1" HTHW	160	122	3.6
3/4	57	1" HTHW	160	110	5.5
1	20	1" HTW	122	74	1.3
3/4	174	1" HTW	122	76	11.6
3/4	70	1" HWR	102	35	2.1
1/2	54	1" HWR	102	30	1.4

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

		Load Mil BTU/Yr
Factor: (160 - 80) / (160 - 68) =	0.87	
Factor: (122 - 80) / (122 - 68) =	0.78	
Factor: (102 - 80) / (102 - 68) =	0.65	

Note: Building 238 DHW pipe insulation repairs are needed for 10 LF of 1-inch supply piping.

Additional heat losses from these pipes are:				
Supply @ 122 Deg F, 1-inch Pipe	800	BTUH/10LF Bare	74	BTUH/10LF 1-inch In
Total Heat Losses			7.01	Mil BTU/Yr Added Lo

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Building 290

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
3/4	60	1	135	84	4.4
3/4	60	1	115	62	3.2

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Factor: (135 - 80) / (135 - 68) = 0.82

Note: Building 290 DHW pipe insulation repairs are needed for 15 LF of 3/4-inch supply piping.

Additional heat losses from these pipes are:				
Supply @ 135 Deg F, 3/4-inch Pipe	600	BTUH/10LF Bare	84	BTUH/10LF 1-inch In
Total Heat Losses			7.88	Mil BTU/Yr Added Lo

Building 295

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
2	270	1	128	168	39.7
1-1/2	300	1	128	116	30.5
1-1/4	330	1	128	97	28.0
1	45	1	128	88	3.5
3/4	320	1	108	48	13.5

Pipes in chases and above ceiling; assume temperature is 80 Degrees F. Adjust above values by factor based on 68 Degrees F ambient temperature for above values:

Load Mil BTU/Yr

Factor: (128 - 80) / (128 - 68) = 0.80
Factor: (108 - 80) / (108 - 68) = 0.70

Note: Building 295 DHW pipe insulation repairs are needed for 10 LF of 2-inch supply piping.

Additional heat losses from these pipes are:				
Supply @ 128 Deg F, 2-inch Pipe	915	BTUH/10LF Bare	165	BTUH/10LF 1-inch In
Total Heat Losses			8.02	Mil BTU/Yr Added Lo

Building 642

Pipe Dia	Length LF	Effective Insul IN	DHW Temp	Heat Loss BTUH/10	Total Loss Mil BTU/Y
1-1/2	94	1	130	120	9.9
1-1/2	94	1	110	70	5.8

PROCESS ELECTRIC ENERGY USE SUMMARY

Usage Code 2: Shops & Warehouses

Shops typically have one small office of about 300 to 500 SF area. It is assumed that each is fitted with a 300 SF office. Energy use from the office is, thus:

272 kW-Hr/Yr for offices

Typical (10,000 SF) shop-type equipment consumes about 4,000 kW-Hr/Yr.

Process energy use for shops is, thus 0.43 kW-Hr/SF-Yr

Warehouses do not consume significant process energy, but are equipped with small offices similar to shops. Process energy use in warehouses is, thus:

Process energy use for warehouses i 0.03 kW-Hr/SF-Yr

Usage Code 3: Barracks & Quarters without Dining

A typical 50-PN barracks without dining consumes about 20,000 kW-Hr/Yr of process energy. Loads satisfied include vending machines, watr coolers, stereos, refrigerators, washing machines and dryers, televisions and various small appliances.

Annual process energy 400 kW-Hr/PN-Yr

Usage Code 4: Barracks & Quarters with Dining

Energy use is the same as for Usage Code 3, except that cooking process energy must be added. See Usage Code 7 Dining Facilities, for the cooking energy component of process energy usage.

Usage Code 5: Recreation Facilities & Gyms without Bathing

Typically, these facilities are equipped with a small office, and minimal other process type electrical equipment. (No saunas are in operation at Fort Hunter-Liggett.)

Annual process energy 0.91 kW-Hr/SF-Yr

Usage Code 5.1: Recreation Facilities & Gyms with Bathing

Process energy use is the same as for Usage Code 5. Domestic hot water (DHW) bathing-energy use is addressed in baseline DHW use calculations.

Usage Code 6: Theaters & Community Facilities

The single theater at Fort Hunter Liggett operates 3 days per week for a period of about 6 hours. Projector equipment load is estimated at 1 kW. A small office of about 300 SF will consume energy proportional (3 Days to % Days) to a small office as described above.

Annual process energy 1,058 kW-Hr/Yr, including projection equipment

Annual process energy 244 kW-Hr/Yr
(two x 300 SF Office equivalent)

PROCESS ELECTRIC ENERGY USE SUMMARY

Usage Code 7: Dining Facilities

Consolidated Dining Facilities (mess halls): Value is based on results of metering several large Dining Facilities of a similar size. The value shown below includes all process energy consumption, including cooking.

Annual process energy	0.90	kW-Hr/Meal, all electric cooking

Usage Code 8: Base Exchanges & Stores

Base exchanges and retail type stores consume electric power for administrative office areas, at check-out stands, for water coolers, vending machines and for product refrigeration. Some facilities also have snack bars.

Annual process energy	1.70	kW-Hr/SF-Yr
Annual Cooking proce	1.50	kW-Hr/Meal, all electric cooking

Usage Code 8.1: Commissaries:

Commissaries consume electric power for administrative office areas, at check-out stands, for water coolers, vending machines and for product refrigeration. Some facilities also have snack bars.

Annual process energy	3.50	kW-Hr/SF-Yr
Annual Cooking proce	1.50	kW-Hr/Meal, all electric cooking

Usage Code 9: Clubs, Officers & NCO, etc.

Cooking Energy Use: Value is based on results of metering several clubs and snack bars of a similar size and configuration. The value shown below includes all process energy consumption, including cooking.

Cooking process ener	1.50	kW-Hr/Meal, all electric cooking

Non-cooking Energy Use: Clubs contain small offices, vending machines, coolers and video games. Values are based on take-offs from several officers and NCO clubs similar to those at Fort Hunter Liggett.

Non-cooking process	2.00	kW-Hr/SF-Yr

Usage Code 10: Family Housing

Process energy use for family housing units is based on metering numerous units and take-offs of equipment and furnishings. The annual value provided includes cooking energy consumption for propane burning stoves and ovens in kitchens.

Family Housing Unit pr	5,900	kW-Hr/Yr Electric Power
	10.5	Mil BTU/Yr Propane Use

Usage Code 11: Schools

There are no schools identified in this EEAP.

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PROCESS ELECTRIC ENERGY USE SUMMARY

Usage Code 11.3: Child Development Centers

Process energy consumption for Child Development Centers includes administrative office equipment, including copying machines, cooking snacks and meals for the children. For the purposes of estimating process energy use, one 300 SF size office is assumed, including copy machine. Meals are prepared using an all-electric kitchen at about the same efficiency as recorded for Usage Code 9 above.

Non-cooking process	272	kW-Hr/Yr
Cooking process ener	0.90	kW-Hr/Meal, all electric cooking

Usage Code 12: Clinics (w/o Beds)

There are no Clinics without beds in this EEAP.

Usage Code 12.1: Hospitals & Clinics with Beds

Non-cooking process	3.40	kW-Hr/SF-Yr
Cooking process ener	0.90	kW-Hr/Meal, all electric cooking

Special, Significant Process Loads

Building 80 Post Exchange:

Refrigeration Equipment:	24.2	kW approx connected load
	4,000	approx full Load Hours
	96,626	kWH/Yr

Building 121 Bowling Center:

Pin Setting Equipment load is about: 2.6 kWH/Yr-SF

Energy use based on detailed studies of similar Army facilities.

Building 182 Commissary:

Refrigeration Equipment:

40.6	kW approx connected load
4,000	approx full Load Hours
162,282	kWH/Yr

Building 238 TEXCOM HQ Building / Photo Lab:

46.2	kW Panel Load Fata
0.57	Diversity Factor @ Panel Rating
0.30	Usage Diversity Assumed
2,080	Hours per Year
16,425	kWH/Yr

Building 301 ADP Building:

188.5	kW Connected Load @ Equipment List
0.30	Usage Diversity Assumed
8,760	Hours per Year
495,272	kWH/Yr

APPENDIX C

Weather Data

APPENDIX C

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FIGURES

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APPENDIX C

WEATHER DATA

Weather data is required for building heating, ventilating and air conditioning (HVAC) analyses and designs. The Army's Engineering Weather Data Technical Manual (TM 5-785) lists heating and cooling system design data for Fort Hunter-Liggett, California (FHL). Design data extracted from this TM appears as Table C-1.

C.1 Development of Hourly Temperature Data for Fort Hunter-Liggett.

Bin type temperature data, provided in TM 5-785 for many locations, is not available for FHL. This type of data is required to accurately model building HVAC system energy consumption for existing conditions and for energy savings modifications to be evaluated.

Available meteorological data is evaluated and adjusted to synthesize a useable data base for FHL. Data sources used in this development include:

(1) TM 5-785 U.S. Army Engineering Weather Data Technical Manual: Design heating and cooling data and annual Heating Degree-Days (H-DD/Yr) for FHL and for Camp Roberts (near Paso Robles) are used. Refer to Table C-1.

(2) Trane Corporation weather data for Paso Robles California: Temperature data is available for use with the Trane Trace HVAC computer simulation program. This data is provided in the form of hourly dry and wet bulb temperatures for a typical day of each month. Paso Robles data, the closest location for which reliable hourly weather data is available, is used as the basis for the synthesis of a day's hourly data for FHL.

(3) Historical average daily minimum and maximum temperatures for FHL: This data is provided by the TECOM Atmospheric Sciences Division, Hunter-Liggett Meteorological Team. This data is based on almost 30 years of records beginning in 1964 and continuing through the present.

The purpose of this project is to reduce energy use. Accurate calculation of energy use by building HVAC systems requires site-specific meteorological data. Adjustments are made to Paso Robles hourly temperature data to synthesize a record for FHL. Temperatures are adjusted until calculated H-DD/Yr based on average daily temperatures match the H-DD/Yr listed in TM 5-785 for FHL. The procedure used for this synthesis is summarized below:

(1) Calculated 65 degree F based H-DD/Yr using hourly temperature data for Paso Robles: 3,540 H-DD/Yr @ hourly temperatures, 1 day per month.

(2) Calculated 65 degree F based H-DD/Yr using average daily temperatures for Paso Robles: 2,898 H-DD/Yr @ average daily temperatures, 1 day per month.

(3) Compared calculated H-DD/Yr for Paso Robles results to H-DD's listed in TM 5-785 for Camp Roberts (very close to Paso Robles) and found that H-DD's calculated from average daily temperatures match those listed in TM 5-785 for Camp Roberts: Camp Roberts has 2,890 H-DD/Yr @ TM 5-785.

(4) Adjusted Paso Robles hourly temperatures at and below 65 degrees until H-DD/Yr calculated based on average daily temperatures matches the H-DD's listed in TM 5-785 for FHL:

FHL 3,332 H-DD/Yr @ TM 5-785
FHL 3,289 H-DD/Yr @ average daily temperatures (-1.3% of TM value)
FHL 4,026 H-DD/Yr @ hourly temperatures, 1 day per month.

(5) Compared data sources available to synthesized hourly temperatures for each month by plotting results. Refer to Figures C-1 through C-8.

(6) Adjusted Paso Robles wet bulb temperatures for the synthesized FHL data to match the profile shown for Paso Robles. Results are plotted on Figures C-2 through C-8.

The comparison of synthesized weather data to records at FHL and Paso Robles shown on Figure C-1 indicates that synthesized temperature data are reasonable.

Note that cooling season temperatures (above about 70 degrees F) are not adjusted from the Paso Robles data. No measure of cooling degree days (or hours) is available for FHL from TM 5-785 upon which to base an adjustment calculation. Based on inspection of summer (cooling) season design and criteria temperatures shown on Table C-1, cooling requirements are about equivalent for Camp Roberts and FHL.

C.2 Daily Degree-Hour Schedules.

Hourly schedules are developed for use in analyses of energy savings calculations for both heating and cooling seasons. Hourly schedules will allow energy use calculations to be tailored to an individual buildings specific operating schedule.

The schedules are shown on Tables C-2 through C-5 for heating and for cooling degree-hours. Calculations use degree-hours rather than degree-days.

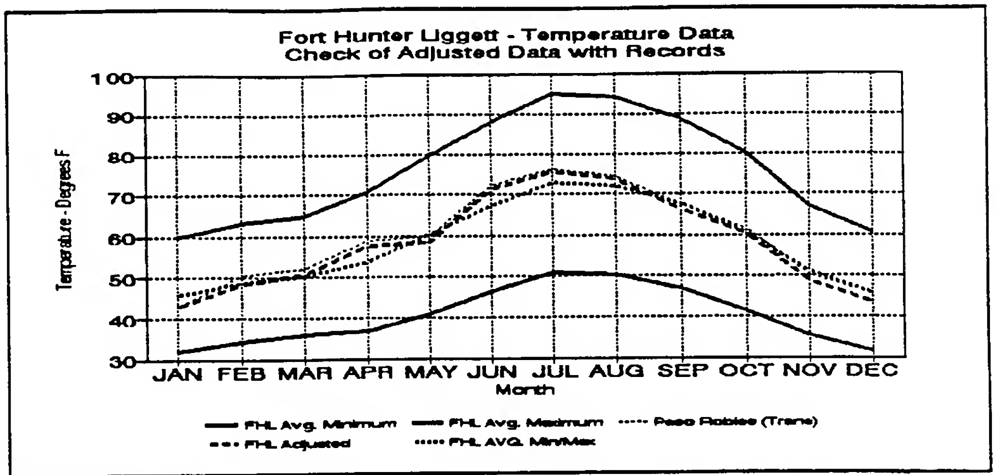

Figure C-1. Check of Synthesized Weather Data Against Records.

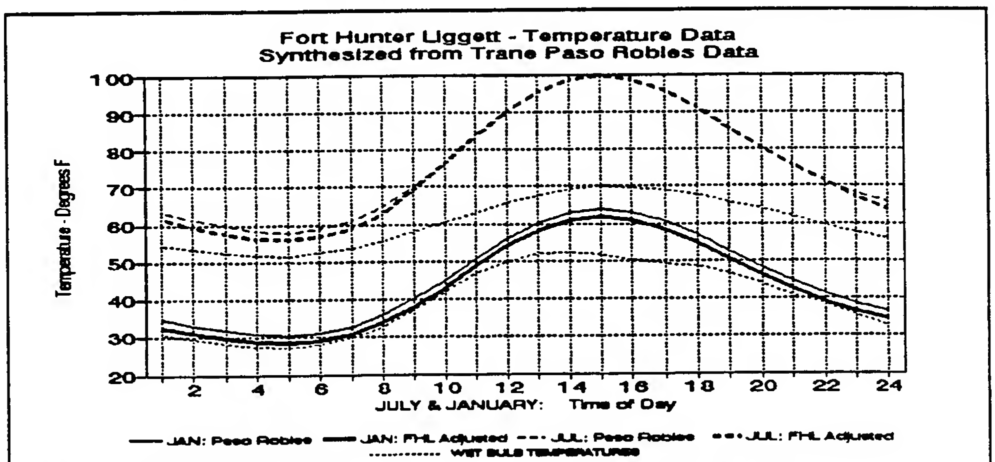

Figure C-2. Synthesized Weather Data For January and July.

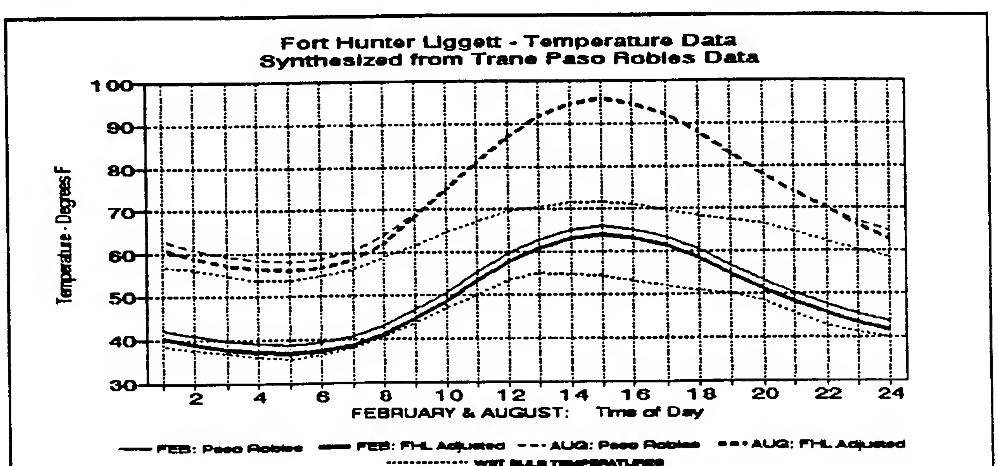

Figure C-3. Synthesized Weather Data For February and August.

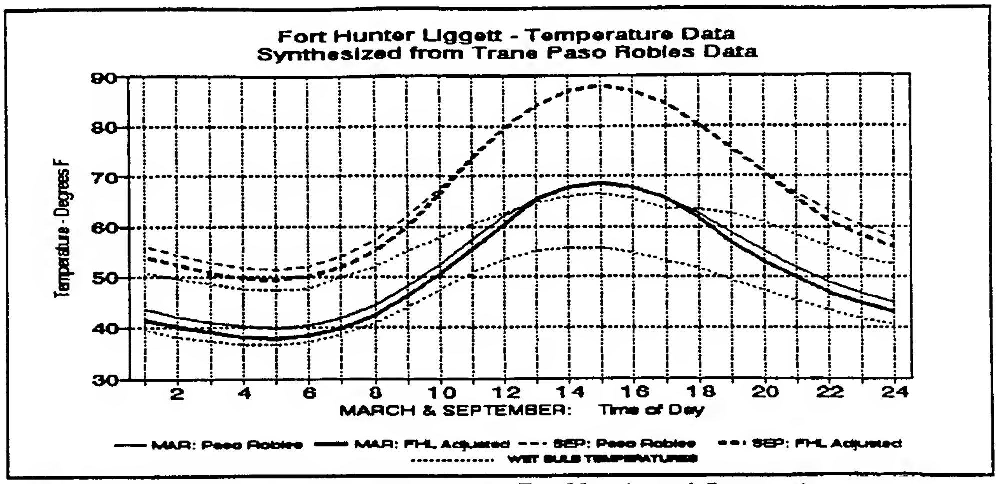

Figure C-4. Synthesized Weather Data For March and September.

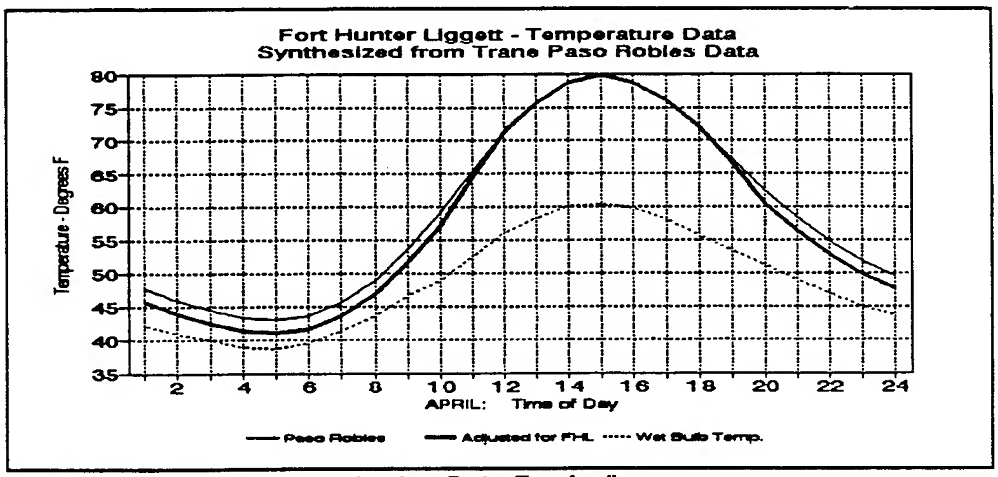

Figure C-5. Synthesized Weather Data For April.

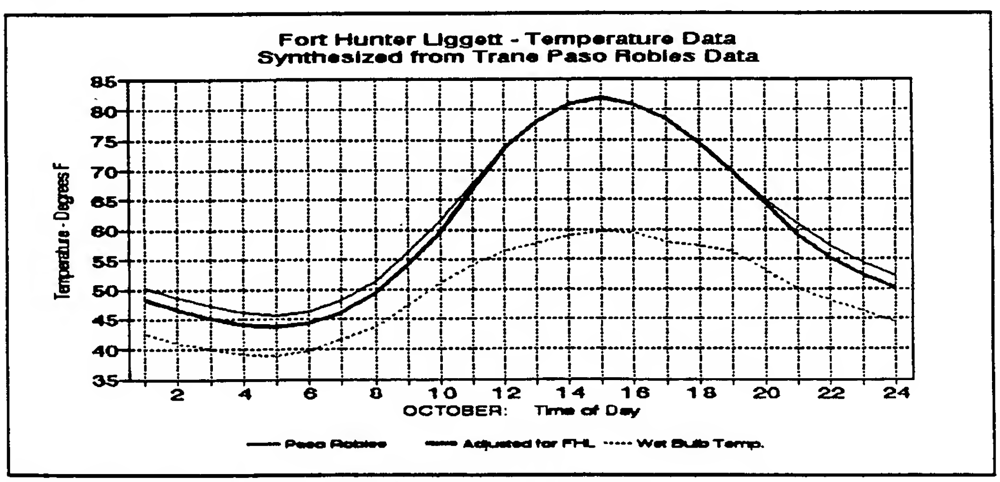

Figure C-6. Synthesized Weather Data For October.

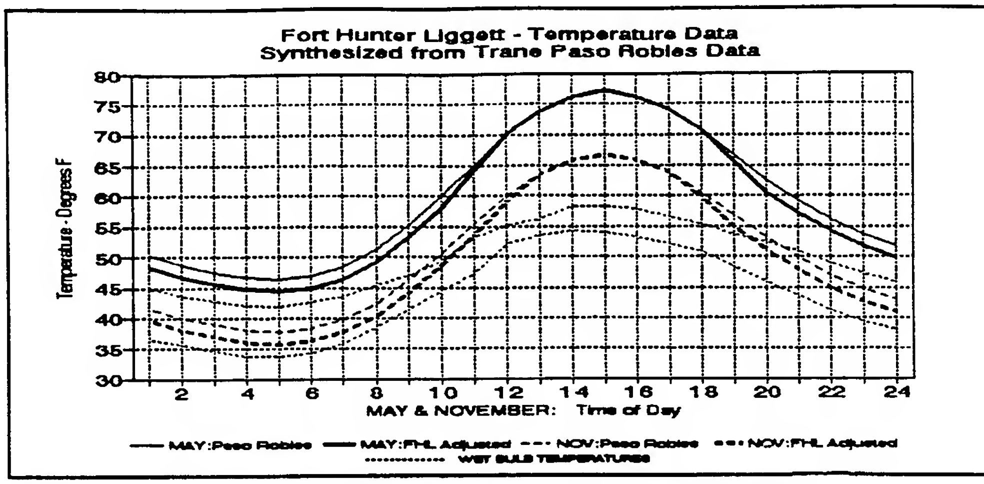

Figure C-7. Synthesized Weather Data For May and November.

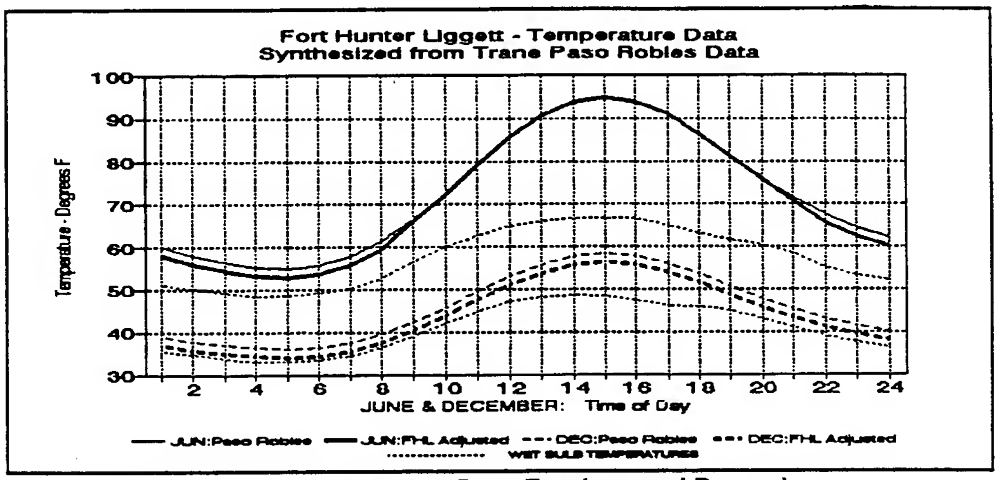

Figure C-8. Synthesized Weather Data For June and December.

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Table C-1. Design Weather Data from TM 5-785.

STATE / Station	Location: Lat (° ′ N)	Location: Long (° ′ W)	Location: Elev (feet)	Winter Design Data Heating, Dry Bulb: 99% (°F)	Winter Dry Bulb: 97.5% (°F)	Winter: Prvlg Wind (dir)	Winter: Mean Speed (knots)	Degree Days: Heating (annual)	Summer Design Data Air Conditioning, Dry Bulb: 1% (°F)	1% MCWB (°F)	Dry Bulb: 2.5% (°F)	2.5% MCWB (°F)	Mean Daily Range (°F)	Prvlg Wind (dir)	Dry Bulb: 5% (°F)	5% MCWB (°F)	Wet Bulb: 1% (°F)	Wet Bulb: 2.5% (°F)	Wet Bulb: 5% (°F)	Summer Criteria Data Air Conditioning, Dry Bulb: ≥ 93°F (hrs)	Dry Bulb: ≥ 80°F (hrs)	Wet Bulb: ≥ 73°F (hrs)	Wet Bulb: ≥ 67°F (hrs)
CALIFORNIA (CONT)																							
Burbank	34 12	118 21	775	37	39	NW	3	1701	95	68	91	68	28	S	88	67	71	70	69	67	711	10	392
Cambria AFS	35 32	121 04	690	35	38	ESE	5	3646	75	61	70	61	16	NW	67	60	63	61	60	2	28	0	3
Camp Parks Comm Annex	37 44	121 53	684	24	27	WNW	5	3035	100	69	97	68	35	NW	93	67	71	70	68	169	863	8	318
Camp Roberts	35 48	120 45	765	24	27	ESE	4	2890	103	69	100	69	45	NW	96	68	73	70	69	275	928	29	296
Castle AFB/Merced	37 23	120 34	188	29	31	ESE	4	2590	102	70	99	69	33	NW	96	68	72	71	70	320	1294	22	505
Centerville Beach	40 34	124 21	280	31	33	E	5	5029	68	60	65	59	15	NW	63	58	62	60	59	0	3	0	1
Chico MAP	39 48	121 51	238	28	30	NW	5	2835	103	69	101	68	33	SSE	98	67	71	70	68	404	1410	15	385
China Lake NAF/Armitage Fld	35 41	117 41	2283	22	25	SW	5	2560	107	68	105	67	33	S	102	66	72	70	68	806	2116	20	301
Chula Vista	32 36	117 05	25	40	41	E	6	1839	78	70	76	69	10	W	74	68	71	70	69	4	34	6	426
Compton	33 53	118 13	65	38	40	NW	4	1606	91	69	87	69	21	NW	84	68	71	70	69	26	486	12	438
Concord NAD	38 01	122 00	23	24	27	WNW	5	3035	100	69	97	68	34	NW	94	67	71	70	68	188	921	8	318
Corona	33 54	117 28	550	28	31	E	3	1875	102	70	98	69	34	W	95	68	74	72	71	214	1134	60	648
Coronado	32 40	117 10	10	40	41	E	6	1839	78	70	76	69	10	W	74	68	71	70	69	4	34	6	426
Costa Mesa ANG Station	33 40	117 53	49	37	39	NE	4	1482	89	69	85	68	23	SW	82	68	71	70	69	20	288	13	475
Crows Landing	37 25	121 06	140	29	31	ESE	4	2767	102	70	99	69	33	NW	96	68	72	71	70	320	1294	22	505
Cuddeback Dry Lake Range	35 18	117 28	2300	20	22	WNW	3	3203	104	67	102	67	35	WSW	99	66	70	69	67	504	1505	6	216
Daggett use Barstow-Daggett																							
Dixon	38 26	121 51	100	30	32	NNW	6	2826	100	69	96	68	36	WSW	92	67	71	69	68	165	815	15	327
Donner Summit	39 19	120 20	7195	-1	3	NE	18	8290	78	54	75	54	19	WSW	73	53	58	56	55	0	13	0	3
Edwards AFB	34 54	117 52	2302	20	22	WNW	3	3077	104	67	102	67	35	WSW	99	66	70	69	67	504	1505	6	216
El Centro NAF	32 49	115 40	-43	35	38	W	6	925	112	74	110	74	30	SE	108	74	81	80	78	1413	3067	904	1832
El Toro MCAS/Santa Ana	33 40	117 44	383	39	41	E	4	1573	92	69	88	70	26	W	85	69	73	71	70	38	502	37	609
Fallbrook Annex	33 21	117 15	703	32	34	E	5	2077	97	70	94	70	29	W	91	69	73	71	70	112	846	37	609
Fort Baker	37 50	122 28	15	38	40	W	5	3080	74	63	71	62	12	W	69	61	64	62	61	0	12	0	8
Fort Barry	37 49	122 32	267	38	40	W	5	3080	74	63	71	62	12	W	69	61	64	62	61	0	12	0	8
Fort Irwin	35 16	116 41	2500	26	29	WNW	7	2547	106	68	104	68	30	W	102	67	73	71	70	809	2133	32	461
Fort MacArthur	33 43	118 18	200	40	42	E	4	1819	83	68	80	68	13	WSW	78	67	70	69	68	3	109	3	291
Fort Mason	37 48	122 26	50	38	40	W	5	3080	74	63	71	62	12	W	69	61	64	62	61	0	12	0	8
Fort Ord/Fritzsche AAF	36 41	121 46	134	30	32	E	5	3818	74	61	70	60	18	W	67	59	62	61	59	1	23	0	2
Fresno/Air Terminal	36 46	119 43	328	28	30	E	4	2650	102	70	100	69	34	WNW	97	68	72	71	70	374	1399	27	524
George AFB/Victorville	34 35	117 23	2875	23	26	S	5	2885	102	66	100	65	31	S	98	64	69	68	67	433	1495	1	160
Hamilton AFB/San Rafael	38 04	122 30	3	30	32	N	4	3311	89	68	84	66	33	SE	80	65	72	69	67	10	184	22	171
Hayward	37 39	122 07	47	32	34	E	5	2909	87	64	83	63	24	WNW	79	62	66	64	63	10	230	0	14
Hunter Liggett Mil Rsvn	36 01	121 14	1090	24	26	N	2	3332	102	71	99	69	46	E	97	67	74	72	70	358	1153	53	440

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Table C-2. Hourly Heating Degree-Hour Data for Fort Hunter Liggett, California.(based on 65 degrees F)

Time of Day	*0100*	*0200*	*0300*	*0400*	*0500*	*0600*	*0700*	*0800*	*0900*	*1000*	*1100*	*1200*
January	1,001	1,051	1,094	1,125	1,135	1,113	1,063	967	834	679	502	335
February	694	734	764	787	795	778	742	672	571	456	328	204
March	725	772	806	834	843	825	781	701	583	450	298	146
April	576	633	675	708	720	699	642	543	399	234	18	0
May	518	567	605	632	642	623	577	490	366	220	28	0
June	210	270	318	354	366	342	282	174	0	0	0	0
July	109	174	226	267	279	254	189	71	0	0	0	0
August	130	189	236	270	282	260	202	93	0	0	0	0
September	327	381	426	459	471	447	393	294	150	0	0	0
October	518	574	617	651	663	642	586	484	335	167	0	0
November	765	810	843	870	879	861	819	741	627	495	348	180
December	871	908	933	955	961	949	915	853	763	657	539	431
TOTAL	6,444	7,062	7,543	7,912	8,036	7,793	7,190	6,082	4,627	3,359	2,061	1,296

Time of Day	*1300*	*1400*	*1500*	*1600*	*1700*	*1800*	*1900*	*2000*	*2100*	*2200*	*2300*	*2400*	*Total*
January	211	127	96	127	202	313	450	586	698	803	887	949	16,346
February	112	50	28	50	104	188	288	389	473	549	610	658	11,026
March	0	0	0	0	0	105	254	369	468	558	629	682	10,828
April	0	0	0	0	0	0	0	135	258	366	456	522	7,584
May	0	0	0	0	0	0	0	136	242	335	412	471	6,863
June	0	0	0	0	0	0	0	0	0	0	78	150	2,544
July	0	0	0	0	0	0	0	0	0	0	0	43	1,612
August	0	0	0	0	0	0	0	0	0	0	0	71	1,733
September	0	0	0	0	0	0	0	0	0	117	207	273	3,945
October	0	0	0	0	0	0	0	19	189	304	394	462	6,603
November	45	0	0	0	36	162	306	417	513	600	669	723	11,709
December	347	291	270	291	341	415	505	595	673	741	797	837	15,838
TOTAL	715	469	394	469	682	1,184	1,803	2,646	3,513	4,372	5,139	5,841	96,632

Table C-3. Hourly Cooling Degree-Hour Data for Fort Hunter Liggett, California. (based on 65 degrees F)

Time of Day	*0100*	*0200*	*0300*	*0400*	*0500*	*0600*	*0700*	*0800*	*0900*	*1000*	*1100*	*1200*
January	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0	0	0	189
May	0	0	0	0	0	0	0	0	0	0	0	158
June	0	0	0	0	0	0	0	0	27	222	426	618
July	0	0	0	0	0	0	0	0	130	357	577	784
August	0	0	0	0	0	0	0	0	105	298	499	685
September	0	0	0	0	0	0	0	0	0	45	261	438
October	0	0	0	0	0	0	0	0	0	0	56	267
November	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	263	921	1,818	3,139

Time of Day	*1300*	*1400*	*1500*	*1600*	*1700*	*1800*	*1900*	*2000*	*2100*	*2200*	*2300*	*2400*	*Total*
January	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0
March	16	87	112	87	22	0	0	0	0	0	0	0	322
April	321	411	444	411	333	213	54	0	0	0	0	0	2,376
May	273	347	378	347	282	177	22	0	0	0	0	0	1,984
June	765	861	897	861	777	642	486	330	168	18	0	0	7,098
July	942	1,045	1,085	1,045	955	812	642	474	329	198	65	0	9,440
August	828	921	958	921	840	710	558	403	273	155	31	0	8,184
September	570	657	690	657	582	459	318	174	21	0	0	0	4,872
October	403	493	527	493	415	291	143	0	0	0	0	0	3,088
November	0	24	51	24	0	0	0	0	0	0	0	0	99
December	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	4,117	4,845	5,142	4,845	4,206	3,304	2,222	1,381	790	371	96	0	37,463

Table C-4. Hourly Heating Degree-Hour Data for Fort Hunter Liggett, California. (based on 70 degrees F)

Time of Day	*0100*	*0200*	*0300*	*0400*	*0500*	*0600*	*0700*	*0800*	*0900*	*1000*	*1100*	*1200*
January	1,156	1,206	1,249	1,280	1,290	1,268	1,218	1,122	989	834	657	490
February	834	874	904	927	935	918	882	812	711	596	468	344
March	880	927	961	989	998	980	936	856	738	605	453	301
April	726	783	825	858	870	849	792	693	549	384	168	0
May	673	722	760	787	797	778	732	645	521	375	183	0
June	360	420	468	504	516	492	432	324	123	0	0	0
July	264	329	381	422	434	409	344	226	25	0	0	0
August	285	344	391	425	437	415	357	248	50	0	0	0
September	477	531	576	609	621	597	543	444	300	105	0	0
October	673	729	772	806	818	797	741	639	490	322	99	0
November	915	960	993	1,020	1,029	1,011	969	891	777	645	498	330
December	1,026	1,063	1,088	1,110	1,116	1,104	1,070	1,008	918	812	694	586
TOTAL	8,269	8,887	9,368	9,737	9,861	9,618	9,015	7,907	6,189	4,679	3,220	2,051

Time of Day	*1300*	*1400*	*1500*	*1600*	*1700*	*1800*	*1900*	*2000*	*2100*	*2200*	*2300*	*2400*	*Total*
January	366	282	251	282	357	468	605	741	853	958	1,042	1,104	20,066
February	252	190	168	190	244	328	428	529	613	689	750	798	14,386
March	140	68	43	68	133	260	409	524	623	713	784	837	14,226
April	0	0	0	0	0	0	96	285	408	516	606	672	10,080
May	0	0	0	0	0	0	133	291	397	490	567	626	9,477
June	0	0	0	0	0	0	0	0	0	132	228	300	4,299
July	0	0	0	0	0	0	0	0	0	0	90	198	3,122
August	0	0	0	0	0	0	0	0	0	0	124	226	3,302
September	0	0	0	0	0	0	0	0	129	267	357	423	5,979
October	0	0	0	0	0	0	12	174	344	459	549	617	9,040
November	195	126	99	126	186	312	456	567	663	750	819	873	15,210
December	502	446	425	446	496	570	660	750	828	896	952	992	19,558
TOTAL	1,455	1,113	986	1,113	1,415	1,939	2,800	3,861	4,857	5,869	6,868	7,666	128,744

Table C-5. Hourly Cooling Degree-Hour Data for Fort Hunter Liggett, California. (based on 70 degrees F)

Time of Day	*0100*	*0200*	*0300*	*0400*	*0500*	*0600*	*0700*	*0800*	*0900*	*1000*	*1100*	*1200*
January	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0	0	0	39
May	0	0	0	0	0	0	0	0	0	0	0	3
June	0	0	0	0	0	0	0	0	0	72	276	468
July	0	0	0	0	0	0	0	0	0	202	422	629
August	0	0	0	0	0	0	0	0	0	143	344	530
September	0	0	0	0	0	0	0	0	0	0	111	288
October	0	0	0	0	0	0	0	0	0	0	0	112
November	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	416	1,153	2,069

Time of Day	*1300*	*1400*	*1500*	*1600*	*1700*	*1800*	*1900*	*2000*	*2100*	*2200*	*2300*	*2400*	*Total*
January	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0
April	171	261	294	261	183	63	0	0	0	0	0	0	1,272
May	118	192	223	192	127	22	0	0	0	0	0	0	877
June	615	711	747	711	627	492	336	180	18	0	0	0	5,253
July	787	890	930	890	800	657	487	319	174	43	0	0	7,229
August	673	766	803	766	685	555	403	248	118	0	0	0	6,033
September	420	507	540	507	432	309	168	24	0	0	0	0	3,306
October	248	338	372	338	260	136	0	0	0	0	0	0	1,804
November	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3,032	3,665	3,909	3,665	3,114	2,234	1,394	771	309	43	0	0	25,774

APPENDIX D

Backup Data:
Building Energy Conservation Opportunity Analyses

APPENDIX D

Table of Contents

ECO No.	ECO Description
DOMESTIC HOT WATER	
C1	Reduce Hot Water Temperatures
C2	Insulate Hot Water Pipes
C3	Insulate Hot Water Storage Tanks
C4	Install Electrical Ignitors in Gas Hot Water Heaters
C5	Install Aerators/Flow Restrictors in Lavatories and Showers
C6	Use Cold Water for Laundering
C7	Replace Electric Booster for Garbage Can Washer
C8	Recover Heat From Dishwasher Hot Water
C9	Install Automatic Draft Damper Controls on DHW Heaters
LIGHTING AND ELECTRICAL	
D3	Retrofit Exterior Lighting With HPS Fixtures
D4	Replace Incandescent Lighting With Fluorescent
D5	Install Electronic Ballasts and T8 Lamps
D8	Improve Power Factor
D9	Replace Motors With High Efficiency Units
D10	Install FM Radio EMCS

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY B/H
CHECKED BY
DATE MAR 1993
REV. 19

ECO A1
CAULK & WEATHER STRIP
DOORS & WINDOWS

PROJECT 16-403-10
FHL EEAP

SHEET NO. 1 OF 14 SHEETS

DESCRIPTION OF ACTION

Infiltration of outdoor air through gaps and cracks around openings in exterior walls increases HVAC energy use. Infiltrating outside air must be conditioned to inside temperature.

Infiltration is reduced with properly sealed openings, thus, HVAC energy use is reduced.

Facilities Included for Evaluation

Buildings included are listed in tabular calculations which follow.

Energy Savings Calculations

Infiltration through Window & Door Cracks:

The attached nomograph is used to determine the infiltration rate based on the design condition wind speed @ TM5-785.

Worst Case Infiltration rate 2.3 CFM/LF CRACK

Block load: Heating:

2.3 CFM × 1.08 × (72-24)/1000 = 0.12 KBTUH

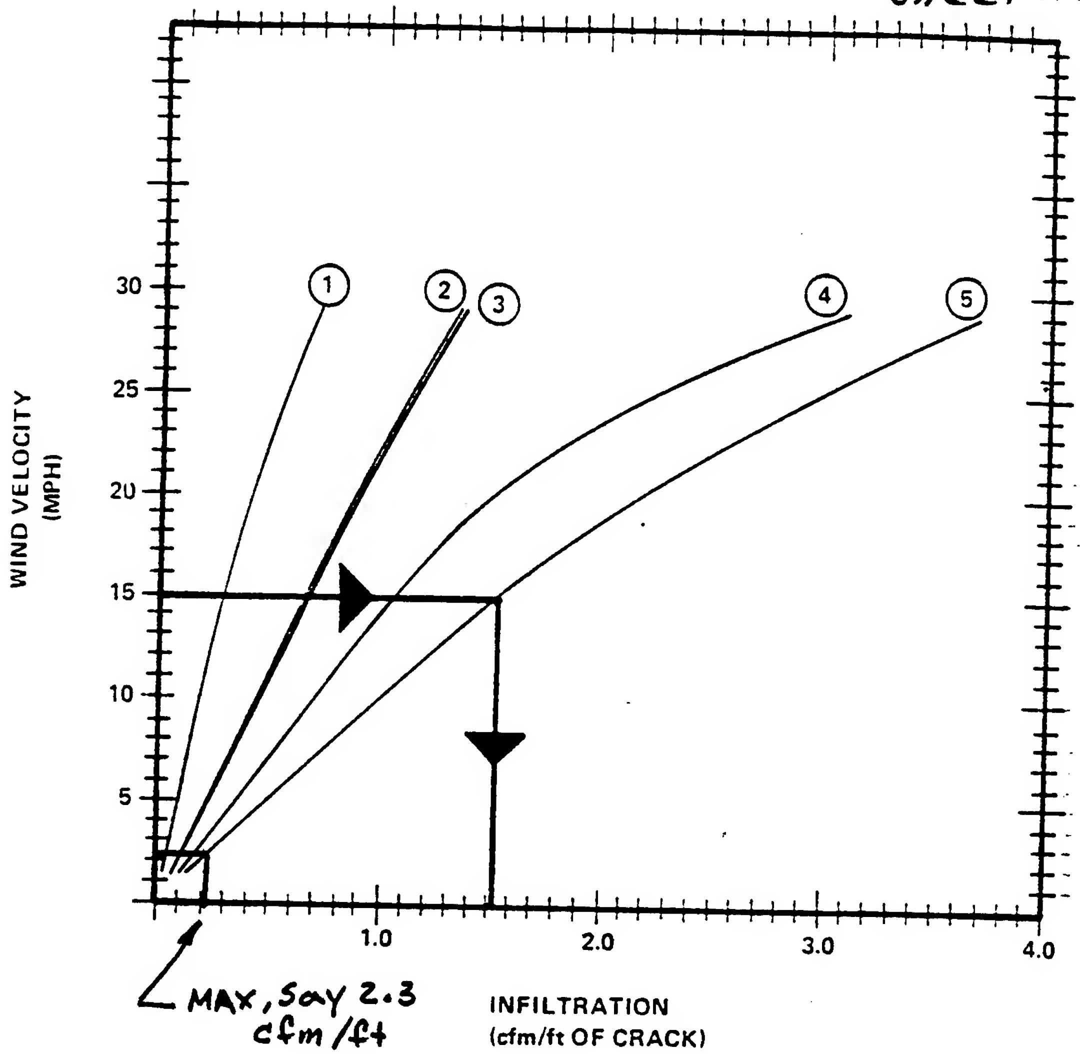
worst case heating η = 56%

fuel savings (Propane most expensive)

0.12/0.56 = 0.22 KBTUH

Continuous deg-hr/yr @72° = 142,323

FORM 101-1/8



KEY:

NO.	TYPE	MATERIAL	WEATHER STRIPPED	FIT
1.	ALL	WOOD	YES	AVERAGE
	HINGED	METAL	YES	AVERAGE
2.	ALL	WOOD	NO	AVERAGE
	HINGED	METAL	NO	AVERAGE
	DOUBLE HUNG	STEEL	NO	AVERAGE
3.	ALL	WOOD	YES	LOOSE
	DOUBLE HUNG	STEEL	YES	AVERAGE
4.	CASEMENT/STEEL	STEEL	NO	AVERAGE
5.	ALL	WOOD	NO	LOOSE
	DOUBLE HUNG	STEEL	NO	AVERAGE

(4) TM5-785, FORT HUNTER-LIGGETT MEAN WIND SPEED = 2 Knots ≅ 2.2 MPH.

FIGURE 8-14. INFILTRATION THROUGH WINDOWS

COMPUTATION SHEET

COMPUTED BY BJH	ECO A1	PROJECT 16-403-10
CHECKED BY	CAULK & WEATHERSTRIP	FHL EEAP
DATE MARCH 1993	DOORS & WINDOWS	
REV. 19__		SHEET NO. 8 OF 14 SHEETS

weatherstripping heating savings:

$$\frac{0.22 \times 142{,}323^{*}}{(72-24)} = 0.631 \times 10^6 \text{ BTU/YR}$$

fuel cost saved: $7.87 × 0.631 = $4.97/Yr.-LF

weatherstripping cooling energy savings:
(for A/C bldgs only - Evap cooled buildings will have no additional energy savings during cooling season.)

Assume COP = 2.6 for "normal case" at FHL.

Heat Gain: 2.3 CFM × 1.08 × (102 - 72)/1000
= 0.074 KBTUH

Cooling Energy use saved:

$$\frac{0.074 \times 10^3 \text{ BTU}}{2.6 \quad \text{H}} \div 3413 \text{ BTU/KWH} = 8 \text{ WH/yr-L saved.}$$

This would require about 1200 LF of crack per bldg to achieve $1/yr saving

⇒ neglect cooling energy savings for this ECO as non-significant.

⇒ EVALUATE WEATHERSTRIPPING ONLY FOR HEATING FUEL SAVINGS

CAULKING ENERGY SAVINGS

Caulking cracks around exterior openings will reduce infiltration as does weather-stripping. CFM savings are estimated at about 1/10 that of crack openings @ nomograph on sheet 2 of this calc. set.

0.23 CFM/LF crack.

COST ESTIMATES

Unit prices for caulking are based on the 1993 Means Construction Cost Estimating Guide and are actually a little lower than the lowest unit cost provided by Means. In-house forces are not available to perform these tasks according to DEH at Fort Hunter Liggett.

ECO A1 INSTALL WEATHER STRIPPING AND CAULK AROUND OPENINGS

ECO A1
Sheet 4 of 14

Bldg 131 Openings

Description	No. Ea	L	H	Crack LF	Caulk LF
Window	14	28	48	233	177
Window	1	135	30	30	28
Door	2	3	7	5	3
Total				268	208
Bldg Floor SF:		998	LF/SF	0.27	0.21

Bldg 6 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Window	6	32	48	104	80
Window	2	20	20	17	13
Window	6	25	33	75	58
Door	3	3	7	7	5
Total				202	156
Bldg Floor SF:		1,090	LF/SF	0.20	0.16
Average, Bldg 6 & 131			LF/SF	0.24	0.18

These factors used for bldgs 124,149,79

Bldg 81 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Door	4	44	86	115	87
Door	1	36	86	28	20
Door	1	72	86	34	26
Total				176	133

Bldg 101 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Door C	1	78	75	26	26
Door E	1	102	120	37	37
Door H	1	88	99	31	31
Window D	2	84	96	0	60
Window G	4	64	63	106	85
Total				199	238
Window F	3	102	120	141	111
Window G	2	64	63	53	42
Window J	2	86	96	77	61
Total				271	214
Door K	18	36	84	360	360
Window A	16	67	84	515	403
Window L	4	84	84	112	112
Window M	8	24	48	128	96

Window N	12	46	36	200	164
Window O	6	48	30	93	78
Total				1,408	1,213

Bldg 120 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Window A	5	45	30	New	63
Window B	1	95	75	New	28
Door C	13	36	79	New	249
Door D	1	36	83	New	20
Window E/F	7	66	28	New	110
Roll-up Dr G	3	150	138	N/A Not Conditioned	
Window H	4	46	54	New	67
Window I	1	64	80	New	24
Window J	4	72	35	New	71
Dbl Door K	1	36	84	New	20
Door L	1	60	84	New	24
Total				0	676

Bldg 127 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Windows	12	66	30	222	192
Doors	2	36	84	40	40
Total				262	232

Bldg 128 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Windows	52	60	48	New	936
Doors	26	36	84	New	520
Total				0	1,456

Bldg 146 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Sliding Wind	4	66	33	77	66
Personnel D	2	36	84	40	40
Sliding Door	1	1120	96	203	203
Total				320	309

Bldg 161 thru 167 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Sliding Wind	20	48	30	310	260
Personnel D	2	36	84	40	40
Total				New	300

Bldg 186 Openings

ECO A1 INSTALL WEATHER STRIPPING AND CAULK AROUND OPENINGS

Eco A1
Sheet 6 of 14

Description	No. Ea	L	W	Crack LF	Caulk LF
Sliding Wind	10	60	48	NA	180
Personnel D	4	60	96	NA	104
Total				NA	284

Bldg 186 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Window 5	1	48	70	NA	20
Window 6	1	48	216	NA	44
Window 4	6	36	66	NA	102
Window 3	2	18	54	NA	24
Door 1	1	72	96	NA	28
Door 3	2	36	84	NA	40
Window 2	4	72	72	NA	96
Door 2	1	36	84	NA	20
Door 20	1	72	96	NA	28
Total				NA	402

Bldg 186 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Window A	2	32	60	Good Co	31
Window B	3	30	41	46	36
Door C	1	32	84	19	19
Door D	2	64	84	63	49
Window E	6	64	48	136	112
Total				264	247

Bldg 205, 207, 208, 229 & 230 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Sliding Wind	100	24	72	2,200	1,600
Single Door	9	3	84	131	131
Double Door	2	60	84	62	48
Total				2,393	1,779

Bldg 241 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
S Wall Door	1	72	84	33	26
W Wall Wind	1	84	36	23	20
W Wall Door	1	60	84	31	24
N Wall Door	1	36	84	20	20
N Wall Door	1	72	84	33	26
E Wall Door	1	216	180	66	66
E Wall Door	2	72	84	52	52
E Wall Door	1	36	84	20	20
Total				278	254

ECO A1
Sheet 7 of 1

Bldg 252 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
F Window	0	72	60	0	0
B Window	0	96	72	0	0
C Window	0	48	72	0	0
D Window	7	40	60	152	117
E Window	0	32	72	0	0
Door - Dbl	3	60	86	95	73
Door - Singl	5	36	86	102	102
Total				348	291

Bldg 256 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
F Window	0	72	60	0	0
B Window	0	96	72	0	0
C Window	0	48	72	0	0
D Window	12	40	60	260	200
E Window	1	32	72	23	17
Door - Dbl	0	60	86	0	0
Door - Singl	2	36	86	41	41
Total				324	258

Bldg 259 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
F Window	16	72	60	432	352
B Window	2	96	72	68	56
C Window	2	48	72	52	40
D Window	0	40	60	0	0
E Window	0	32	72	0	0
Door - Dbl	3	60	86	95	73
Door - Singl	10	36	86	203	203
Total				850	724

Bldg 290 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
A Window	4	70	34	81	69
B Door - Sin	3	36	84	60	60
C Door - Dbl	4	72	84	132	104
D Window	1	48	30	16	13
E Window	1	48	36	New	14
Total				288	260

Bldg 291 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF

A Window	1	60	48	22	18
B Door - Dbl	1	72	84	33	26
C Door - Sin	1	36	84	20	20
D Roll-up Do	2	144	144	96	96
Total				171	160

Bldg 295 Openings

Description	No. Ea	L	W	Crack LF	Caulk LF
Dbl Hng Met	91	72	63	2,525	2,048
Door - Dbl	2	60	84	62	48
Door-Single	9	36	84	180	180
Total				2,767	2,276

ENERGY SAVINGS CALCULATION:

Energy savings are determined per linear foot of crack in the preceding hand calculations. The energy savings per LF of crack is estimated at: 2.3 CFM/LF crack

Energy savings will actually be only 1/2 of this amount due to conservation of mass: infiltrating exterior air displaces conditioned air. Thus, infiltration may come in one side of the building while exfiltration occurs on the other side.

For weatherstripping, thus, assume: 1.15 CFM/LF crack

Heating energy is lost between the temperature of the outside air and the conditioned air. Assume conditioned space is at 72 Degrees, the heat losses are a function of the building schedule.

Fac No.	HVAC ECO Applicability						ECO A1 Energy Savings			ECO A1 Energy Cost Savings N (Years) 5					Cost Analysis			
	ECO A1 Whrstrip	ECO A1 Caulk	Total Crack LF	Total Caulk LF	Heat Ld BTUH	Heat FLH/Yr	Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Year	Propane $/Year	Fuel Oil $/Year	Total $/Year	LCC $ Saved	Constr Cost $	Investmnt $	Paybac Years	SIR
T 6	Yes	Yes	202	156	12,429	1,480	-	2.8	-	$0	$22	$0	$22	$105	$1,257	$1,402	63.9	0.07
P 41A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 41B			wait to caulk & ws															
P 42A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 42B			wait to caulk & ws															
P 43A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 43B			wait to caulk & ws															
P 44A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 44B			wait to caulk & ws															
P 45A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 45B			wait to caulk & ws															
P 46		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 47		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 51A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 51B			wait to caulk & ws															
P 52A		Yes	Bldg almost new			1,480				-	-	-	-	-	-	-	-	-
P 52B			wait to caulk & ws															
P 53		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-			
P 54		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 55		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 56		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 57		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 58		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 59		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
P 60		Yes	New: wait to c & ws			1,480				-	-	-	-	-	-	-	-	-
S 79	Yes	Yes	34	28	2,102	436	268	-	-	$20	$0	$0	$20	$90	$215	$239	12.0	0.000
P 80						425				-	-	-	-	-	-	-	-	-
P 81	Yes	Yes	176	133	10,836	277	-	4.1	-	$0	$32	$0	$32	$153	$1,092	$1,218	38.2	0.125
P 101	Yes		199	238	12,750	318	-	6.0	-	$0	$47	$0	$47	$225	$1,392	$1,552	33.0	0.145
			271	214	16,677	475	-	11.7	-	$0	$92	$0	$92	$440	$1,693	$1,887	20.5	0.233
			1,408	1,213	43,676	2,144	27,434	-	-	$2,045	$0	$0	$2,045	$9,182	$8,985	$10,018	4.9	0.916
P 116						745				-	-	-	-	-	-	-	-	-
						1,070												
T 120	Yes	Yes	0	676	3,859	1,364				-	-	-	-	-	-	-	-	-
T 121						911				-	-	-	-	-	-	-	-	-
T 124	Yes	Yes	537	417	33,065	1,480	-	75.3	-	$0	$593	$0	$593	$2,838	$3,347	$3,732	6.3	0.761
T 127	Yes	Yes	262	232	16,294	1,364	-	34.7	-	$0	$273	$0	$273	$1,309	$1,684	$1,877	6.9	0.697
P 128	[illegible]	Yes	0	1,456	8,318	1,364	-	15.5	[illegible]	$0	$122	$0	$122	$586	$2,606	$2,[illegible]	23.8	0.202
T 131	Y[illegible]	Yes	67	52	4,123	1,480	-	10.0	-	$0	$79	$0	$79	$377	$417	$4[illegible]	5.9	0.811

Fac No.	HVAC ECO Applicability						ECO A1 Energy Savings			ECO A1 Energy Cost Savings N (Years) 5					Cost Analysis			
	ECO A1 Whrstrip	ECO A1 Caulk	Total Crack LF	Total Caulk LF	Heat Ld BTUH	Heat FLH/Yr	Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Year	Propane $/Year	Fuel Oil $/Year	Total $/Year	LCC $ Saved	Constr Cost $	Investmnt $	Paybac Years	SIR
S 144	Yes	Yes	NA: Bldg not used							-	-	-	-	-	-	-	-	-
S 146	Yes	Yes	320	309	20,027	281	-	9.1	-	$0	$71	$0	$71	$342	$2,100	$2,342	32.8	0.146
T 149	Yes	Yes	160	125	9,881	1,480	-	22.5	-	$0	$177	$0	$177	$848	$1,000	$1,115	6.3	0.761
T 156	Yes	Yes	NA: Not enough HVAC energy use			281				-	-	-	-	-	-	-	-	-
T 158										-	-	-	-	-	-	-	-	-
T 161		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
T 162		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
T 163		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
T 164		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
T 165		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
T 166		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
T 167		Yes	New	300	1,714	756	-	1.8	-	$0	$14	$0	$14	$68	$537	$599	42.2	0.113
S 168						0				-	-	-	-	-	-	-	-	-
T 172						-				-	-	-	-	-	-	-	-	-
P 177						756				-	-	-	-	-	-	-	-	-
P 178	Yes		New Renov good cnd			1,022				-	-	-	-	-	-	-	-	-
S 182						568				-	-	-	-	-	-	-	-	-
S 186		Yes	NA	284	1,623	756	-	1.9	-	$0	$15	$0	$15	$70	$508	$567	38.7	0.124
P 190		Yes	NA	402	2,295	1,163	-	-	3.6	$0	$0	$18	$18	$86	$719	$802	44.5	0.107
S 197	Yes	Yes	264	247	16,517	756 2,626	-	18.1	-	$0	$142	$0	$142	$682	$1,722	$1,920	13.5	0.355
S 198						392				-	-	-	-	-	-	-	-	-
P 205 P 205A	Yes	Yes	2,393	1,779	146,849	1,137	-	-	232.8	$0	$0	$1,159	$1,159	$5,531	$14,766	$16,464	14.2	0.336
P 206	Yes					2,626				-	-	-	-	-	-	-	-	-
P 207 P 207A	Yes	Yes	2,393	1,779	146,849	1,364	-	-	280.5	$0	$0	$1,397	$1,397	$6,664	$14,766	$16,464	11.8	0.405
P 208 P 208A	Yes	Yes	2,393	1,779	146,849	1,364	-	-	277.7	$0	$0	$1,383	$1,383	$6,596	$14,766	$16,464	11.9	0.401
P 209						953				-	-	-	-	-	-	-	-	-
P 210						2,626				-	-	-	-	-	-	-	-	-
P 211										-	-	-	-	-	-	-	-	-
P 212						453				-	-	-	-	-	-	-	-	-
P 219						453				-	-	-	-	-	-	-	-	-
P 229 P 229A	Yes	Yes	2,393	1,779	146,849	1,364	-	-	278.5	$0	$0	$1,387	$1,387	$6,615	$14,766	$16,464	11.9	0.402
P 230 P 230A	Yes	Yes	2,393	1,779	146,849	1,364	-	-	281.5	$0	$0	$1,402	$1,402	$6,686	$14,766	$16,464	11.7	0.406
S 235						756				-	-	-	-	-	-	-	-	-
S 236						756				-	-	-	-	-	-	-	-	-
S 237						756				-	-	-	-	-	-	-	-	-

ECO A1
Sheet 11 of 14

Fac No.	HVAC ECO Applicability						ECO A1 Energy Savings			ECO A1 Energy Cost Savings N (Years) 5					Cost Analysis			
	ECO A1 Whrstrip	ECO A1 Caulk	Total Crack LF	Total Caulk LF	Heat Ld BTUH	Heat FLH/Yr	Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Year	Propane $/Year	Fuel Oil $/Year	Total $/Year	LCC $ Saved	Constr Cost $	Investmnt $	Paybac Years	SIR
S 238						756				-	-	-	-	-	-	-	-	-
P 240						756				-	-	-	-	-	-	-	-	-
S 241		Yes	278	254	17,334	756	-	19.7	-	$0	$155	$0	$155	$743	$1,800	$2,008	12.9	0.370
S 243						756				-	-	-	-	-	-	-	-	-
S 244						756				-	-	-	-	-	-	-	-	-
S 246						756				-	-	-	-	-	-	-	-	-
S 247						756				-	-	-	-	-	-	-	-	-
P 252	Yes	Yes	348	291	21,537	625	-	-	18.4	$0	$0	$92	$92	$438	$2,205	$2,459	26.8	0.178
P 256	Yes	Yes	324	258	19,985	625	-	-	17.4	$0	$0	$87	$87	$414	$2,030	$2,264	26.1	0.183
P 259	Yes	Yes	850	724	52,691	625	-	-	44.6	$0	$0	$222	$222	$1,059	$5,411	$6,033	27.2	0.176
S 283						288				-	-	-	-	-	-	-	-	-
S 286						756				-	-	-	-	-	-	-	-	-
P 287						410				-	-	-	-	-	-	-	-	-
S 288						756				-	-	-	-	-	-	-	-	-
S 290	Yes	Yes	288	260	17,951	756	-	21.3	-	$0	$168	$0	$168	$802	$1,861	$2,075	12.4	0.387
S 291	Yes	Yes	171	160	10,684	756	-	13.5	-	$0	$106	$0	$106	$509	$1,114	$1,242	11.7	0.410
P 295	Yes	Yes	2,767	2,276	171,099	1,364	-	391.1	-	$0	$3,078	$0	$3,078	$14,745	$17,469	$19,478	6.3	0.757
P 301						756 2,626				-	-	-	-	-	-	-	-	-
P 642						NA				-	-	-	-	-	-	-	-	-
S 2201						125				-	-	-	-	-	-	-	-	-
Totals			20,889	21,397			27,703	670	1,435	$2,065	$5,271	$7,146	$14,483	$68,609	$138,215	$154,110	10.6	0.445

NO BUILDINGS HAVE AN SIR > 1.0

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet	12 Of 14
Project	EEAP Limited Energy Study
Project No.	
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO# A-1 Caulk & Weatherstrip
Estimator	BIH
Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Weatherstripping	1	LF	$1.89	$1.89	$1.19	$1.19	$3.08
Subtotal							$3.08
Sales Tax at 8%							$0.25
Subtotal							$3.33
Contractor OH & P							$1.00
Subtotal							$4.32
Bond at 1%							$0.04
Subtotal							$4.37
Estimating Contingency at 10%							$0.44
Total Probable Construction Cost							$4.80

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993	Sheet 13 Of 14	
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO# A-1 Caulk & Weatherstrip	Estimator: BIH	Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Caulking	1	LF	$1.00	$1.00	$0.15	$0.15	$1.15
Subtotal							$1.15
Sales Tax at 8%							$0.09
Subtotal							$1.24
Contractor OH & P							$0.37
Subtotal							$1.61
Bond at 1%							$0.02
Subtotal							$1.63
Estimating Contingency at 10%							$0.16
Total Probable Construction Cost							$1.79

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: Caulk and Weatherstrip Doors and Windows   Fiscal Year FY96
Discrete Portion Name: ECO# A-1
Analysis Date: March 1993   Economic Life: 5 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$138,215		
B. SIOH	$7,602		
C. Design Cost	$8,293		
D. Total Cost (1A+1B+1C)	$154,110		
E. Salvage Value of Existing Equipment			
F. Public Utility Company Rebate			
G. Total Investment (1D-1E-1F)			$154,110

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	94.2	$2,057	4.49	$9,236
B. Dist	$4.98	1435	$7,146	4.77	$34,088
C. Propane	$7.87	670	$5,273	4.79	$25,257
D. Other					
E. Demand Savings					
F. Total			$14,476		$68,581

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		4.45	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	10.6	Years
5. Total Net Discounted Savings (2F5+3C):	$68,581	
6. Savings to Investment Ratio (SIR) 5/1G:	0.45	
7. Adjusted Internal Rate of Return (AIRR):	-20.86%	

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY B/H CHECKED BY DATE MARCH 1993 REV. 19	ECO A2 INSTALL DOUBLE GLAZING — WINDOWS	PROJECT 16-403-10 FHL EEAP SHEET NO. 1 OF 1 SHEETS

Description

Double glazed windows reduce heat transfer. Both space heating and cooling energy are saved. Double glazing, as a retrofit, requires a climate with below freezing winters and/or very warm summers.

Analysis

Based on experience evaluating this type of project as a retrofit at many locations of divergent climates, retrofitting FHL windows for double glazing will not be economic.

This project is not evaluated for FHL.

The Facility Engineer is encouraged, however, to consider using double glazed panels for glass replacements when in conditioned spaces. Installation and materials costs are about the same as for standard pane glass as the manufacture of double glazed panels is automated.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BH
DATE MARCH 1993
REV. 19__

ECO A3
INSULATE EXTERIOR
WALLS

PROJECT 16-403-10
FTL SEAF

SHEET NO. 1 OF 14 SHEETS

DESCRIPTION OF ACTION

BUILDINGS WHICH CURRENTLY DO NOT HAVE EXTERIOR WALL INSULATION WILL BE INSULATED

FACILITIES INCLUDED

BLDG 144 ECO NOT RECOMMENDED DUE TO BUILDING USE

156 ECO NOT RECOMMENDED DUE TO BUILDING FUNCTION

2300 SF 177 **

1400 SF 252 *

* BUILDING ANALYSED USING REPRESENTATIVE TRACE 600 ANALYSIS

** BUILDING MODELED USING TRACE 600 ANALYSIS.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

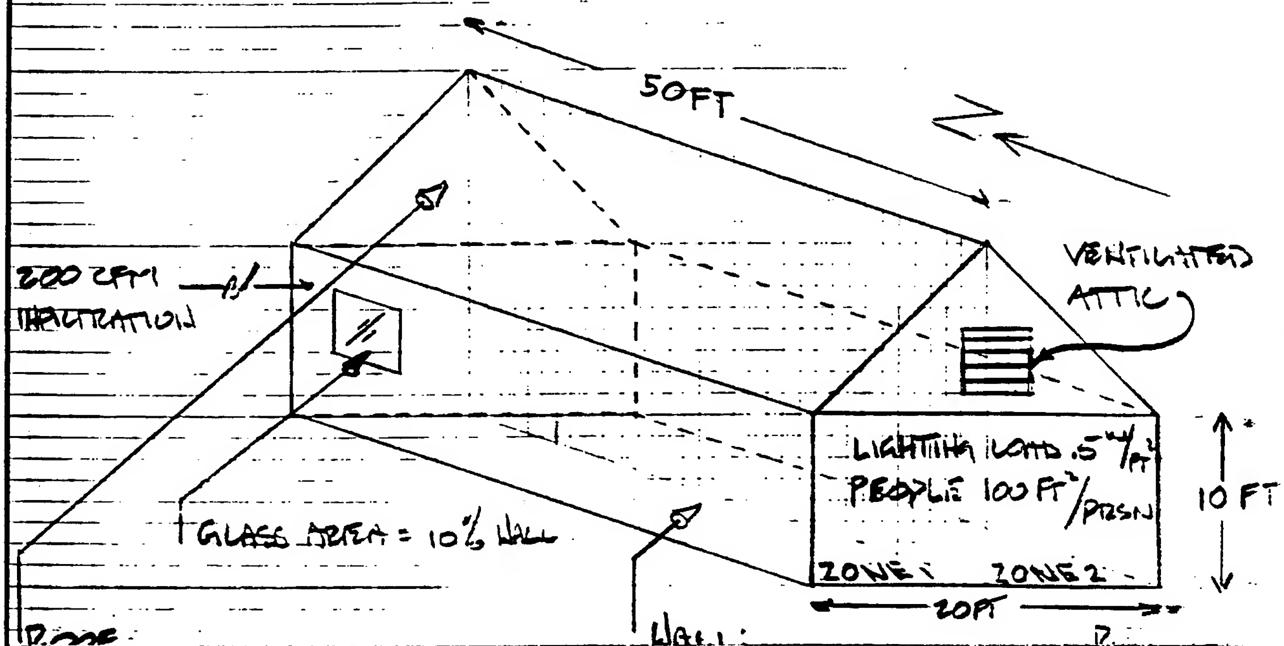
COMPUTED BY RJB
CHECKED BY PJH
DATE MARCH 1983
REV. 19__

ECO # A-3
INSULATE EXTERIOR WALLS

PROJECT 16-423-10
FTL BEAP

SHEET NO. 2 OF 14 SHEETS

THE FOLLOWING BUILDING WAS MODELED FOR A REPRESENTATIVE TRANE 600 ANALYSIS



ROOF:

	R
OUTSIDE AIR	0.25
BUILT UP ROOF	0.33
R-19 INSULATION	19
AIR SPACE	0.61
SUSPENDED CLNG	2.38
INSIDE AIR	0.61
	23.18
U = 1/R	0.04

WALL:

	W/O INSULATION R_W	WITH INSULATION $R_{W/O}$
OUTSIDE AIR	0.25	0.25
WOOD WALL BOARD	0.93	0.93
RIGID INSULATION	4	--
GYP BOARD	0.56	0.56
INSIDE AIR	0.68	0.68
	6.42	2.42
U = 1/R	0.16	0.41

FORM 101-1/8

SHEET 3 OF 14

ECO# A-4

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/18					Mo/Hr: 7/18		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 91/ 68/ 70.0					OADB: 91		OADB: 27		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	2,272		2,272	3.92	0	0.00	0	-1,468	5.16
Glass Solar	16,940	0		16,940	29.25	18,550	39.05	0	0	0.00
Glass Cond	2,002	0		2,002	3.46	1,523	3.21	-6,291	-6,291	22.11
Wall Cond	24,108	6,594		30,702	53.01	23,224	48.89	-16,474	-20,688	72.72
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	43,050	8,865		51,915	89.63	43,297	91.14	-22,765	-28,447	100.00
Internal Loads										
Lights	1,707	0		1,707	2.95	1,707	3.59	0	0	0.00
People	4,300			4,300	7.42	1,800	3.79	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	6,007	0	0	6,007	10.37	3,506	7.38	0	0	0.00
Ceiling Load	812	-812		0	0.00	704	1.48	-515	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	49,868	8,054	0	57,922	100.00	47,507	100.00	-23,280	-28,447	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	4.8	57.9	55.4	3,170	77.5	63.3	66.9	61.2	57.3	66.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	4.8	57.9								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-37.2	3,170	63.9	74.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	3,170	64.2	61.2
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-37.2			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	3,170	3,170
Mincfm	0	0
Return	3,170	3,170
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	3.17
Clg Cfm/Ton	656.65
Clg Sqft/Ton	207.18
Clg Btuh/Sqft	57.92
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	3.17
Htg Btuh/SqFt	-37.22

TEMPERATURES (F)

Type	Clg	Htg
SADB	61.2	74.8
Plenum	77.6	63.7
Return	77.5	64.2
Ret/OA	77.5	64.2
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

ECO# A-4
ECO# A-3

SHEET 4 OF 14
ECO# A-3

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 7/18				*	Mo/Hr: 7/18		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 91/ 68/ 70.0				*	OADB: 91		*		OADB: 27	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	1,958		1,958	5.01	*	0	0.00	*	0	-1,508	9.47
Glass Solar	18,550	0		18,550	47.42	*	18,550	56.57	*	0	0	0.00
Glass Cond	1,523	0		1,523	3.89	*	1,523	4.64	*	-6,291	-6,291	39.53
Wall Cond	8,671	2,410		11,081	28.33	*	8,671	26.44	*	-6,429	-8,117	51.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	28,744	4,369		33,112	84.65	*	28,744	87.66	*	-12,720	-15,916	100.00
Internal Loads						*			*			
Lights	1,707	0		1,707	4.36	*	1,707	5.20	*	0	0	0.00
People	4,300			4,300	10.99	*	1,800	5.49	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	6,007	0	0	6,007	15.35	*	3,506	10.69	*	0	0	0.00
Ceiling Load	474	-474		0	0.00	*	540	1.65	*	-418	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	35,225	3,894	0	39,119	100.00	*	32,790	100.00	*	-13,138	-15,916	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	3.3	39.1	36.6	2,064	76.5	62.9	66.9	60.3	56.6	64.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	3.3	39.1								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-20.5	2,064	64.7	73.9
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,064	65.0	60.3
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-20.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	2,064	2,064
Mincfm	0	0
Return	2,064	2,064
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	2.06
Clg Cfm/Ton	633.22
Clg Sqft/Ton	306.76
Clg Btuh/Sqft	39.12
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	2.06
Htg Btuh/SqFt	-20.52

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.3	73.9
Plenum	76.5	64.7
Return	76.5	65.0
Ret/OA	76.5	65.0
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

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**                                                                          **
**               T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                          **
**               by             **
**                                                                          **
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BUILDING 177 (TECH LIBRARY)
FHL
FHL
KELLER AND GANNON
USE MODIFIED PASO ROBLES WEATHER DATA

Weather File Code:	PASOROBL	
Location:		
Latitude:	35.0	(deg)
Longitude:	120.0	(deg)
Time Zone:	8	
Elevation:	765	(ft)
Barometric Pressure:	29.1	(in. Hg)
Summer Clearness Number:	1.05	
Winter Clearness Number:	0.95	
Summer Design Dry Bulb:	100	(F)
Summer Design Wet Bulb:	70	(F)
Winter Design Dry Bulb:	27	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0738	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	1.0829	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,766.9	(Btu-min./hr/cuft)
Enthalpy Factor:	4.4302	(Lb-min./hr/cuft)

Design Simulation Period: June To November
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:25:49 3/ 7/93
Dataset Name: 177INSUL .TM

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 7/17		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 95/ 72/ 84.0					OADB: 96		OADB: 27		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	3,527		3,527	2.69	0	0.00	0	-1,564	2.18
Glass Solar	65,442	0		65,442	49.87	68,239	60.20	0	0	0.00
Glass Cond	4,512	0		4,512	3.44	4,305	3.80	-14,073	-14,073	19.62
Wall Cond	6,225	1,594		7,818	5.96	8,459	7.46	-22,628	-28,903	40.31
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	5,276			5,276	4.02	3,065	2.70	-8,880	-8,880	12.38
Sub Total==>	81,454	5,121		86,574	65.98	84,068	74.17	-45,581	-53,420	74.49
Internal Loads										
Lights	23,891	0		23,891	18.21	23,891	21.08	0	0	0.00
People	3,360			3,360	2.56	1,520	1.34	0	0	0.00
Misc	3,072	0	0	3,072	2.34	3,072	2.71	0	0	0.00
Sub Total==>	30,323	0	0	30,323	23.11	28,483	25.13	0	0	0.00
Ceiling Load	1,509	-1,509		0	0.00	801	0.71	-1,020	0	0.00
Outside Air	0	0	0	14,997	11.43	0	0.00	0	-20,173	28.13
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		-674	0	-674	-0.51		0.00		1,883	-2.63
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	113,285	2,937	0	131,220	100.00	113,351	100.00	-46,602	-71,711	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	10.9	131.2	120.8	7,698	76.6	63.2	68.1	61.4	57.6	67.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	10.9	131.2								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	3,600		
Part	0		
ExFlr	0		
Roof	900	0	0
Wall	2,600	355	14

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-92.0	7,698	62.6	73.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	7,698	61.9	61.4
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-92.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	651	454
Infil	200	200
Supply	7,698	7,698
Mincfm	0	0
Return	7,648	7,698
Exhaust	601	454
Rm Exh	100	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	8.5
Clg Cfm/Sqft	2.14
Clg Cfm/Ton	703.98
Clg Sqft/Ton	329.22
Clg Btuh/Sqft	36.45
No. People	8
Htg % OA	5.9
Htg Cfm/SqFt	2.14
Htg Btuh/SqFt	-25.55

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	61.4	73.6
Plenum	76.3	64.7
Return	75.6	65.1
Ret/OA	76.6	62.9
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

SHEET 7 OF 14
ECO # A-3

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 7/17		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 95/ 72/ 84.0					OADB: 96		OADB: 27		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	3,525		3,525	2.79	0	0.00	0	-1,595	2.79
Glass Solar	65,442	0		65,442	51.72	68,342	62.64	0	0	0.00
Glass Cond	4,512	0		4,512	3.57	4,334	3.97	-14,073	-14,073	24.58
Wall Cond	3,112	800		3,912	3.09	4,067	3.73	-11,314	-14,526	25.37
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	5,276			5,276	4.17	3,222	2.95	-8,880	-8,880	15.51
Sub Total==>	78,341	4,325		82,666	65.34	79,965	73.29	-34,267	-39,075	68.24
Internal Loads										
Lights	23,891	0		23,891	18.88	23,891	21.90	0	0	0.00
People	3,360			3,360	2.66	1,520	1.39	0	0	0.00
Misc	3,072	0	0	3,072	2.43	3,072	2.82	0	0	0.00
Sub Total==>	30,323	0	0	30,323	23.97	28,483	26.10	0	0	0.00
Ceiling Load	1,470	-1,470		0	0.00	664	0.61	-644	0	0.00
Outside Air	0	0	0	14,104	11.15	0	0.00	0	-19,403	33.89
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		-573	0	-573	-0.45		0.00		1,220	-2.13
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	110,134	2,282	0	126,520	100.00	109,111	100.00	-34,912	-57,258	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	10.5	126.5	116.5	7,419	76.4	63.2	68.1	61.4	57.6	66.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	10.5	126.5								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	3,600		
Part	0		
ExFlr	0		
Roof	900	0	0
Wall	2,600	355	14

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-69.8	7,419	63.7	72.3
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	7,419	62.9	61.4
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-69.8			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	622	437
Infil	200	200
Supply	7,419	7,419
Mincfm	0	0
Return	7,369	7,419
Exhaust	572	437
Rm Exh	100	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	8.4
Clg Cfm/Sqft	2.06
Clg Cfm/Ton	703.67
Clg Sqft/Ton	341.45
Clg Btuh/Sqft	35.14
No. People	8
Htg % OA	5.9
Htg Cfm/SqFt	2.06
Htg Btuh/SqFt	-19.40

TEMPERATURES (F)

Type	Clg	Htg
SADB	61.4	72.3
Plenum	76.3	65.6
Return	75.5	66.2
Ret/OA	76.4	63.9
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY R.B.
CHECKED BY BHT
DATE MARCH 1993
REV. 19__

ECO# A-3
INSULATE EXTERIOR WALLS
ENERGY CALCULATIONS

PROJECT 6-403-10
FT. FEAD

SHEET NO. 5 OF 14 SHEETS

BLDG 252

COOLING:

BASE LINE 57,922

ECO# A-2 39,119 18 803 BTUH/1000 SF

= 13.8 BTUH/SF

ASSUME EER = 10

ΔWATTS = $13.8/10$ = 1.88 W/SF

HEATING:

BASE LINE 28447 BTUH

ECO# A-3 15916 12,531/1000

= 12.5 BTUH/SF

BLDG 177

COOLING:

BASELINE 131220

ECO# A-3 126520 4700 BTUH/3600 SF

= 1.3 BTUH/SF

ASSUME EER = 10

ΔWATTS = $1.3/10$ = .13 W/SF

HEATING:

BASE LINE 71,711

ECO# A-3 57,258 14,453 BTUH/3600 SF

= 4 BTUH/SF

FORM 101-1/8

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 9 Of 14
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO# A-3 Insulate Exterior Walls	Estimator	Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 177							
1" Polysterene Rigid Insulation	2600	SF	$5	$11,700	$3	$8,294	$19,994
Stucco Covering	2600	SF	$5	$13,000	$4	$9,360	$22,360
Sub Total (Building 177)							$42,354
Building 252							
1" Polysterene Rigid Insulation	1400	SF	$5	$6,300	$3	$4,466	$10,766
Stucco Covering	1400	SF	$5	$7,000	$4	$5,040	$12,040
Sub Total (Building 252)							$22,806

SHEET 10 OF 14
ECO A-3

Bldg	Area (SF)	Heating Degree Hours	Cooling Degree Hours	Heating Efficiency	Energy Use W/Previous ECO's Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Energy Use W/ECO-A4 Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Savings Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6	1,090	93,192	21,833	66.0%	5,818	44		4,972	23.9	-	846	20.1	0.0	$63	$158	$0	$221
120	9,120	85,120	21,833	66.0%	15,216	768.5											
124	2,001	93,192	21,833	65.0%	12,702	183.2		11,148	145.8	-	1,554	37.4	0.0	$116	$294	$0	$410
127	2,250	85,120	21,833	64.0%	2,783	193.1		1,036	154.1	-	1,747	39.0	0.0	$130	$307	$0	$437
131	998	93,192	21,833	61.0%	5,265	37.3		4,490	17.4	-	775	19.9	0.0	$58	$157	$0	$214
144	7,172	93,192	21,833	67.0%	418	52.5											
156	2,025	11,702	9,003	NA	823												
161	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
162	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
163	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
164	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
165	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
166	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
167	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
177	3,599	60,531	15,420	66.4%	10,869	6.1											
178	3,599	74,412	19,953	65.0%	12,405	63.8											
206	16,768	116,562	21,833	70.8%	108,696		3944.7										
207	27,238	85,120	21,833	71.4%	268,495		1375										
208	26,999	85,120	21,833	72.1%			1375										
229	26,692	85,120	21,833	71.9%	286,764		1375										
230	36,063	85,120	21,833	71.2%	276,379		1375										
240	3,000	60,531	15,420	67.0%	18,805	38.2											
241	10,000	60,531	15,420	66.6%	162,971	153											
243	3,000	60,531	15,420	67.0%	18,805	38.2											
244	3,000	60,531	15,420	67.0%	18,805	38.2											
246	3,000	60,531	15,420	67.0%	18,805	38.2											
247	3,000	60,531	15,420	67.0%	18,805	38.2											
252	12,299	39,863	15,420	73.0%	27,085		919	20,340	-	831.4	6,745	0.0	87.6	$503	$0	$436	$939
286	3,000	60,531	15,420	67.0%	18,805	38.2											
295	41,002	85,120	21,833	58.7%	629,841	1040											
											20,306	289	88	$1,514	$2,275	$436	

SHEET 11 OF 14
ECO A-3

Bldg	Energy Use W/ECO-A3 Electric Kwh/Yr	Energy Use W/ECO-A3 Propane MBTU/Yr	Energy Use W/ECO-A3 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total
6										
120										
124										
127										
131										
144										
156										
161										
162										
163										
164										
165										
166										
167										
177	10,629	5.00	-	240	1	0	$18	$9	$0	$27
178										
206										
207										
208										
229										
230										
240										
241										
243										
244										
246										
247										
252	16,378	-	744	3,962	0	88	$295	$0	$436	$732
266										
296										
				4,202	1	88	$313	$9	$436	

Bldg	Energy Use W/ECO-A5 Electric Kwh/Yr	Energy Use W/ECO-A5 Propane MBTU/Yr	Energy Use W/ECO-A5 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total
6										
120	10,835			4,381	0	0	$327	$0	$0	$327
124										
127	1,702			1,081	0	0	$81	$0	$0	$81
131										
144										
156										
161	3,109			763	0	0	$57	$0	$0	$57
162	3,109			763	0	0	$57	$0	$0	$57
163	3,109			763	0	0	$57	$0	$0	$57
164	3,109			763	0	0	$57	$0	$0	$57
165	3,109			763	0	0	$57	$0	$0	$57
166	3,109			763	0	0	$57	$0	$0	$57
167	3,109			763	0	0	$57	$0	$0	$57
177	9,648			980	0	0	$73	$0	$0	$73
178	10,625			1,580	0	0	$118	$0	$0	$118
206	100,642			8,054	0	0	$600	$0	$0	$600
207	255,412			13,083	0	0	$975	$0	$0	$975
208	255,527			12,968	0	0	$967	$0	$0	$967
229	273,943			12,821	0	0	$956	$0	$0	$956
230	259,057			17,322	0	0	$1,291	$0	$0	$1,291
240	17,787			1,018	0	0	$76	$0	$0	$76
241	162,123			848	0	0	$63	$0	$0	$63
243	17,787			1,018	0	0	$76	$0	$0	$76
244	17,787			1,018	0	0	$76	$0	$0	$76
246	17,787			1,018	0	0	$76	$0	$0	$76
247	17,787			1,018	0	0	$76	$0	$0	$76
252										
266	17,787			1,018	0	0	$76	$0	$0	$76
296	610,147			19,694	0	0	$1,468	$0	$0	$1,468
				104,262	0	0	$7,772	$0	$0	

SHEET 12 OF 14
ECO # A-3

Bldg	Energy Use W/ECO-A7			Savings			Savings			
	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6										
120	7,583			3,252	0.0	0.0	$242	$0	$0	$242
124										
127	900			802	0.0	0.0	$60	$0	$0	$60
131										
144										
156										
161	2,542			567	0.0	0.0	$42	$0	$0	$42
162	2,542			567	0.0	0.0	$42	$0	$0	$42
163	2,542			567	0.0	0.0	$42	$0	$0	$42
164	2,542			567	0.0	0.0	$42	$0	$0	$42
165	2,542			567	0.0	0.0	$42	$0	$0	$42
166	2,542			567	0.0	0.0	$42	$0	$0	$42
167	2,542			567	0.0	0.0	$42	$0	$0	$42
177	8,742			906	0.0	0.0	$68	$0	$0	$68
178	9,652			1,173	0.0	0.0	$87	$0	$0	$87
206										
207										
208										
229										
230										
240	17,032			756	0.0	0.0	$56	$0	$0	$56
241	161,493			630	0.0	0.0	$47	$0	$0	$47
243	17,032			756	0.0	0.0	$56	$0	$0	$56
244	17,032			756	0.0	0.0	$56	$0	$0	$56
246	17,032			756	0.0	0.0	$56	$0	$0	$56
247	17,032			756	0.0	0.0	$56	$0	$0	$56
252										
286	17,032			756	0.0	0.0	$56	$0	$0	$56
295										
				15,264	0	0	$1,138	0	0	

ECO-A3 COST SAVINGS

Building	Construction Cost	O&M/YR	Total	Sales Tax	OH & P	Bond	Contingenc	Savings	SIR
177	$42,354	$0	$42,354	$45,742	$59,465	$60,060	$66,066	$259	0.0
252	$22,806	$0	$22,806	$24,630	$32,020	$32,340	$35,574	$7,194	0.2

Construction Cost....Installed Cost
O&M/YR...................Yearly maintenance
Sales Tax...................8% of total
OH & P......................Contractors overhead and profit 30%
Bond..........................1%
Contingency.............Estimators contingency 10%
Savings....................Yearly savings multiplied by UPW factor for 20 years (13.59)
SIR.............................Savings/(Cost+Maint*UPW)

Life Cycle Cost Analysis Summary — ECO A-3

Energy Conservation Investment Program (ECIP) — Sheet 14 of 14

Location: Fort Hunter Liggett, California	Region No. 4	Project No. 16-403-10
Project Title: Insulate Exterior Walls		Fiscal Year FY96
Discrete Portion Name: ECO# A-3		
Analysis Date: March 1993	Economic Life: 20 YEARS	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$104,180	
B. SIOH	$5,730	
C. Design Cost	$6,251	
D. Total Cost (1A+1B+1C)	$116,161	
E. Salvage Value of Existing Equipment		
F. Public Utility Company Rebate		
G. Total Investment (1D-1E-1F)		$116,161

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	14.0	$305	14.53	$4,436
B. Dist	$4.98	47	$234	17.63	$4,126
C. Propane	$7.87	1	$8	18.59	$146
D. Other					
E. Demand Savings					
F. Total			$547		$8,709

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		13.59	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	212.3	Years
5. Total Net Discounted Savings (2F5+3C):	$8,709	
6. Savings to Investment Ratio (SIR) 5/1G:	0.07	
7. Adjusted Internal Rate of Return (AIRR):	-16.38%	

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H CHECKED BY DATE MARCH 1993 REV. 19__	ECO A4 INSULATE CEILINGS / ROOFS	PROJECT 16-403-10 FHL - IEEAP SHEET NO. 1 OF 11 SHEETS

DESCRIPTION OF ACTION

BUILDING WHICH CURRENTLY DO NOT HAVE CEILING INSULATION WILL BE INSULATED.

FACILITIES INCLUDED

BLDG 6 *

101 - ECO NOT RECOMMENDED DUE TO HISTORICAL NATURE

124 *

127 *

131 *

144 - ECO NOT RECOMMENDED DUE TO BUILDING USE

156 - ECO NOT RECOMMENDED DUE TO BUILDING FUNCTION

161 *

162 *

252 *

* BUILDINGS ANALYZED USING REPRESENTATIVE TRACE 600 ANALYSIS.

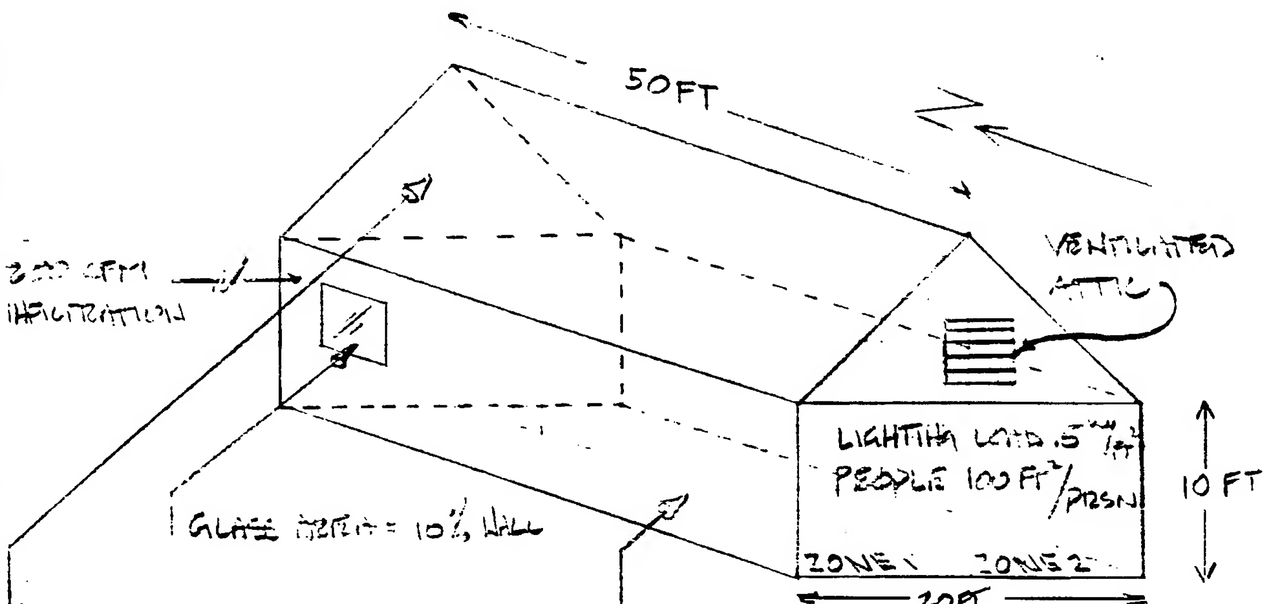
FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RJB CHECKED BY EHT DATE 1 MARCH 1983 REV. ______ 19__	TECH A-4 INSULATE CEILINGS / ROOFS (PART 600 MODEL ...)	PROJECT K?-403-10 SHEET NO. 2 OF 11 SHEETS

THE FOLLOWING BUILDING WAS MODELED FOR A REPRESENTATIVE TITLE 600 ANALYSIS



ROOF

W/O INSULATION WITH INSULATION

	R_w	$R_{w/o}$
OUTSIDE AIR	0.25	0.25
BUILT UP ROOF	0.33	0.33
R-19 INSULATION	19	—
AIR SPACE	0.61	0.61
SUSPENDED CLNG	2.33	2.38
INSIDE AIR	0.61	0.61
	23.13	4.18
U =	0.04	0.24

WALL:

	R
OUTSIDE AIR	0.25
WOOD WALL BOARD	0.93
RIGID INSULATION	4
GYP BOARD	0.56
INSIDE AIR	0.68
	6.42

U = 1/R = 0.16

FORM 101-1/8

SHEET 3 OF 11
ECO A-4

BASELINE

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

****** COOLING COIL PEAK ******						* CLG SPACE PEAK *		* HEATING COIL PEAK *		
Peaked at Time ==>		Mo/Hr: 7/17				Mo/Hr: 7/18			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 96/ 70/ 70.0				OADB: 91			OADB: 27	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	14,919		14,919	21.75	0	0.00	0	-7,898	22.93
Glass Solar	15,120	0		15,120	22.04	16,940	35.17	0	0	0.00
Glass Cond	2,421	0		2,421	3.53	2,002	4.16	-6,291	-6,291	18.27
Wall Cond	23,987	6,143		30,130	43.92	24,108	50.05	-16,474	-20,252	58.80
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	41,528	21,062		62,590	91.24	43,050	89.37	-22,765	-34,440	100.00
Internal Loads										
Lights	1,707	0		1,707	2.49	1,707	3.54	0	0	0.00
People	4,300			4,300	6.27	1,800	3.74	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	6,007	0	0	6,007	8.76	3,506	7.28	0	0	0.00
Ceiling Load	1,961	-1,961		0	0.00	1,614	3.35	-1,109	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	49,496	19,100	0	68,596	100.00	48,170	100.00	-23,873	-34,440	100.00

---COOLING COIL SELECTION---

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	5.7	68.6	66.1	3,219	81.1	64.5	66.9	61.2	57.5	67.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.7	68.6								

---AREAS---

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

---HEATING COIL SELECTION---

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-50.6	3,219	60.3	74.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-1.5	3,219	60.7	61.2
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-50.6			

---AIRFLOWS (cfm)---

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	3,219	3,219
Mincfm	0	0
Return	3,219	3,219
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	3.22
Clg Cfm/Ton	563.16
Clg Sqft/Ton	174.94
Clg Btuh/Sqft	68.60
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	3.22
Htg Btuh/SqFt	-50.61

--TEMPERATURES (F)--

Type	Clg	Htg
SADB	61.2	74.8
Plenum	81.2	59.9
Return	81.1	60.7
Ret/OA	81.1	60.7
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

SHEET 4 of 11

ECO# A-4

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

***** COOLING COIL PEAK *****						*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/18					*	Mo/Hr: 7/18		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 91/ 68/ 70.0					*	OADB: 91		*	OADB: 27		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	2,272		2,272	3.92	*	0	0.00	*	0	-1,468	5.16
Glass Solar	16,940	0		16,940	29.25	*	18,550	39.05	*	0	0	0.00
Glass Cond	2,002	0		2,002	3.46	*	1,523	3.21	*	-6,291	-6,291	22.11
Wall Cond	24,108	6,594		30,702	53.01	*	23,224	48.89	*	-16,474	-20,688	72.72
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	43,050	8,865		51,915	89.63	*	43,297	91.14	*	-22,765	-28,447	100.00
Internal Loads						*			*			
Lights	1,707	0		1,707	2.95	*	1,707	3.59	*	0	0	0.00
People	4,300			4,300	7.42	*	1,800	3.79	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	6,007	0	0	6,007	10.37	*	3,506	7.38	*	0	0	0.00
Ceiling Load	812	-812		0	0.00	*	704	1.48	*	-515	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	49,868	8,054	0	57,922	100.00	*	47,507	100.00	*	-23,280	-28,447	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	4.8	57.9	55.4	3,170	77.5	63.3	66.9	61.2	57.3	66.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	4.8	57.9								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-37.2	3,170	63.9	74.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	3,170	64.2	61.2
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-37.2			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	3,170	3,170
Mincfm	0	0
Return	3,170	3,170
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	3.17
Clg Cfm/Ton	656.65
Clg Sqft/Ton	207.18
Clg Btuh/Sqft	57.92
No. People	10
Htg % OA	0.0
Htg Cfm/Sqft	3.17
Htg Btuh/SqFt	-37.22

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	61.2	74.8
Plenum	77.6	63.7
Return	77.5	64.2
Ret/OA	77.5	64.2
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB CHECKED BY FJH DATE MARCH 1993 REV. 19__	ECO# A-4 INSULATE CEILINGS / ROOFS ENERGY CALCULATIONS	PROJECT 16-403-10 FTR FEAP SHEET NO. 5 OF 11 SHEETS

COOLING:

BASELINE 68596

ECO# A-4 57,922 10,674 BTUH /1000 SF

= 10.67 BTUH/SF

ASSUME EER = 10

USING EER = $\frac{\text{BTUH OUT}}{\text{WATTS IN}}$

$\Delta \text{WATTS} = \frac{\text{BTU}_1}{10} - \frac{\text{BTU}_2}{10} = \frac{10.67 \text{ BTU/SF}}{10}$

= 1.067 W/SF

HEATING:

BASELINE 34440 BTUH

ECO# A-4 28447 BTUH 5993 BTUH /1000 SF

SHEET 5 OF 11
ECO A-4

Bldg	Area (SF)	Heating Degree Hours	Cooling Degree Hours	Heating Efficiency	Energy Use W/Previous ECO's			Energy Use W/ECO-A4			Savings			Savings			
					Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6	1,090	93,192	21,833	66.0%	5,818	44		4,972	23.9	-	846	20.1	0.0	$63	$158	$0	$221
120	9,120	85,120	21,833	66.0%	15,216	768.5											
124	2,001	93,192	21,833	65.0%	12,702	183.2		11,148	145.8	-	1,554	37.4	0.0	$116	$294	$0	$410
127	2,250	85,120	21,833	64.0%	2,783	193.1		1,036	154.1	-	1,747	39.0	0.0	$130	$307	$0	$437
131	998	93,192	21,833	61.0%	5,265	37.3		4,490	17.4	-	775	19.9	0.0	$58	$157	$0	$214
144	7,172	93,192	21,833	67.0%	418	52.5											
156	2,025	11,702	9,003	NA	823												
161	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
162	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
163	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
164	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
165	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
166	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
167	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
177	3,599	60,531	15,420	66.4%	10,869	6.1											
178	3,599	74,412	19,953	65.0%	12,405	63.8											
206	16,768	116,562	21,833	70.8%	108,696		3944.7										
207	27,238	85,120	21,833	71.4%	268,495		1375										
208	26,999	85,120	21,833	72.1%			1375										
229	26,692	85,120	21,833	71.9%	286,764		1375										
230	36,063	85,120	21,833	71.2%	276,379		1375										
240	3,000	60,531	15,420	67.0%	18,805	38.2											
241	10,000	60,531	15,420	66.6%	162,971	153											
243	3,000	60,531	15,420	67.0%	18,805	38.2											
244	3,000	60,531	15,420	67.0%	18,805	38.2											
246	3,000	60,531	15,420	67.0%	18,805	38.2											
247	3,000	60,531	15,420	67.0%	18,805	38.2											
252	12,299	39,883	15,420	73.0%	27,085		919	20,340	-	831.4	6,745	0.0	87.6	$503	$0	$436	$939
286	3,000	60,531	15,420	67.0%	18,805	38.2											
295	41,002	85,120	21,833	58.7%	629,841	1040											
											20,306	289	88	$1,514	$2,275	$436	

SHEET 7 OF 11
ECO A-4

Bldg	Energy Use W/ECO-A3			Savings			Savings				Energy Use W/ECO-A5			Savings			Savings			
	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6																				
120											10,835			4,381	0	0	$327	$0	$0	$327
124																				
127											1,702			1,081	0	0	$81	$0	$0	$81
131																				
144																				
156																				
161											3,109			763	0	0	$57	$0	$0	$57
162											3,109			763	0	0	$57	$0	$0	$57
163											3,109			763	0	0	$57	$0	$0	$57
164											3,109			763	0	0	$57	$0	$0	$57
165											3,109			763	0	0	$57	$0	$0	$57
166											3,109			763	0	0	$57	$0	$0	$57
167											3,109			763	0	0	$57	$0	$0	$57
177	10,629	5.00	-	240	1	0	$18	$9	$0	$27	9,648			980	0	0	$73	$0	$0	$73
178											10,825			1,580	0	0	$118	$0	$0	$118
206											100,642			8,054	0	0	$600	$0	$0	$600
207											255,412			13,083	0	0	$975	$0	$0	$975
208											255,527			12,968	0	0	$967	$0	$0	$967
229											273,943			12,821	0	0	$956	$0	$0	$956
230											259,057			17,322	0	0	$1,291	$0	$0	$1,291
240											17,787			1,018	0	0	$76	$0	$0	$76
241											162,123			848	0	0	$63	$0	$0	$63
243											17,787			1,018	0	0	$76	$0	$0	$76
244											17,787			1,018	0	0	$76	$0	$0	$76
246											17,787			1,018	0	0	$76	$0	$0	$76
247											17,787			1,018	0	0	$76	$0	$0	$76
252	16,378	-	744	3,962	0	88	$295	$0	$436	$732										
266											17,787			1,018	0	0	$76	$0	$0	$76
295											610,147			19,694	0	0	$1,468	$0	$0	$1,468
				4,202	1	88	$313	$9	$436					104,262	0	0	$7,772	$0	$0	

SHEET 8 OF 11
ECO A-4

Bldg	Energy Use W/ECO-A7			Savings			Savings			
	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6										
120	7,583			3,252	0.0	0.0	$242	$0	$0	$242
124										
127	900			802	0.0	0.0	$60	$0	$0	$60
131										
144										
156										
161	2,542			567	0.0	0.0	$42	$0	$0	$42
162	2,542			567	0.0	0.0	$42	$0	$0	$42
163	2,542			567	0.0	0.0	$42	$0	$0	$42
164	2,542			567	0.0	0.0	$42	$0	$0	$42
165	2,542			567	0.0	0.0	$42	$0	$0	$42
166	2,542			567	0.0	0.0	$42	$0	$0	$42
167	2,542			567	0.0	0.0	$42	$0	$0	$42
177	8,742			906	0.0	0.0	$68	$0	$0	$68
178	9,652			1,173	0.0	0.0	$87	$0	$0	$87
206										
207										
208										
229										
230										
240	17,032			756	0.0	0.0	$56	$0	$0	$56
241	157,060			2,519	0.0	0.0	$188	$0	$0	$188
243	17,032			756	0.0	0.0	$56	$0	$0	$56
244	17,032			756	0.0	0.0	$56	$0	$0	$56
246	17,032			756	0.0	0.0	$56	$0	$0	$56
247	17,032			756	0.0	0.0	$56	$0	$0	$56
252										
286	17,032			756	0.0	0.0	$56	$0	$0	$56
295										
				17,153	0	0	$1,279	0	0	

CONSTRUCTION COST ESTIMATE

	Date Prepared: February 1993	Sheet 9 Of 11
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO A-4 Insulate Ceilings/Roofs	Estimator	Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 6							
R-19 Batt Insulation	1090	SF	$0.24	$262	$0.50	$545	$807
Subtotal Building 6							$807
Building 124							
R-19 Batt Insulation	2000	SF	$0.24	$480	$0.50	$1,000	$1,480
Subtotal Building 124							$1,480
Building 127							
R-19 Batt Insulation	2250	SF	$0.24	$540	$0.50	$1,125	$1,665
Subtotal Building 127							$1,665
Building 131							
R-19 Batt Insulation	1000	SF	$0.24	$240	$0.50	$500	$740
Subtotal Building 131							$740
Building 161							
R-19 Batt Insulation	2250	SF	$0.24	$540	$0.50	$1,125	$1,665
Subtotal Building 161							$1,665
Building 162							
R-19 Batt Insulation	2250	SF	$0.24	$540	$0.50	$1,125	$1,665
Subtotal Building 162							$1,665
Building 252							
R-19 Batt Insulation	12300	SF	$0.24	$2,952	$0.50	$6,150	$9,102
Subtotal Building 252							$9,102

ECO A-4 COST SAVINGS

Building	Construction Cost	O&M/YR	Total	Sales Tax	OH & P	Bond	Contingenc	Savings	SIR
6	$807	$0	$807	$872	$1,133	$1,144	$1,259	$3,003	2.4
124	$1,480	$0	$1,480	$1,598	$2,078	$2,099	$2,309	$5,571	2.4
127	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$5,938	2.3
131	$740	$0	$740	$799	$1,039	$1,049	$1,154	$2,908	2.5
161	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
162	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
163	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
164	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
165	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
166	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
167	$1,665	$0	$1,665	$1,798	$2,338	$2,361	$2,597	$3,887	1.5
252	$9,102	$0	$9,102	$9,830	$12,779	$12,907	$14,198	$12,761	0.9

Construction Cost....Installed Cost
O&M/YR..................Yearly maintenance scheduled as 2.5% of installed cost
Sales Tax..................8% of total
OH & P.....................Contractors overhead and profit 30%
Bond..........................1%
Contingency.............Estimators contingency 10%
Savings....................Yearly savings multiplied by UPW factor for 20 years (13.59)
SIR.............................Savings/(Cost+Maint*UPW)

~~SHEET~~ 5 OF 11
ECO A-4

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO A-4
Sheet ● of 11
11

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: Insulate Ceilings/Roofs — Fiscal Year FY96
Discrete Portion Name: ECO# A-4
Analysis Date: March 1993 — Economic Life: 20 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$25,498		
B. SIOH	$1,402		
C. Design Cost	$1,530		
D. Total Cost (1A+1B+1C)	$28,430		
E. Salvage Value of Existing Equipment			
F. Public Utility Company Rebate			
G. Total Investment (1D-1E-1F)			$28,430

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	69.0	$1,507	14.53	$21,896
B. Dist	$4.98	88	$438	17.63	$7,726
C. Propane	$7.87	289	$2,274	18.59	$42,282
D. Other					
E. Demand Savings					
F. Total			$4,220		$71,904

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		13.59	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	6.7	Years
5. Total Net Discounted Savings (2F5+3C):	$71,904	
6. Savings to Investment Ratio (SIR) 5/1G:	2.53	
7. Adjusted Internal Rate of Return (AIRR):	13.70%	

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RWB CHECKED BY JH DATE MARCH 1983 REV. 19__	ECO #-A5 INSTALL SOLAR FILM PROJECT DESCRIPTION	PROJECT 16-403-10 TC EEAP SHEET NO. 1 OF 13 SHEETS

DESCRIPTION OF ACTION.

A SOLAR FILM WILL BE APPLIED TO THE WINDOWS OF THE BUILDINGS SELECTED. THIS FILM WILL INCREASE THE WINDOWS REFLECTIVITY AND THUS DECREASE THE OVERALL RADIATIVE HEAT TRANSFER THROUGH THE WINDOW DUE TO THE SUN. THIS, IN TURN, WILL DECREASE THE COOLING LOAD OF THE BUILDING SAVING ELECTRICAL USE OF THE A/C EQUIPMENT.

FACILITIES INVOLVED

BLDG

120	229
127	230
161	240
162	241
177	295
178	
206	
207	
208	

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

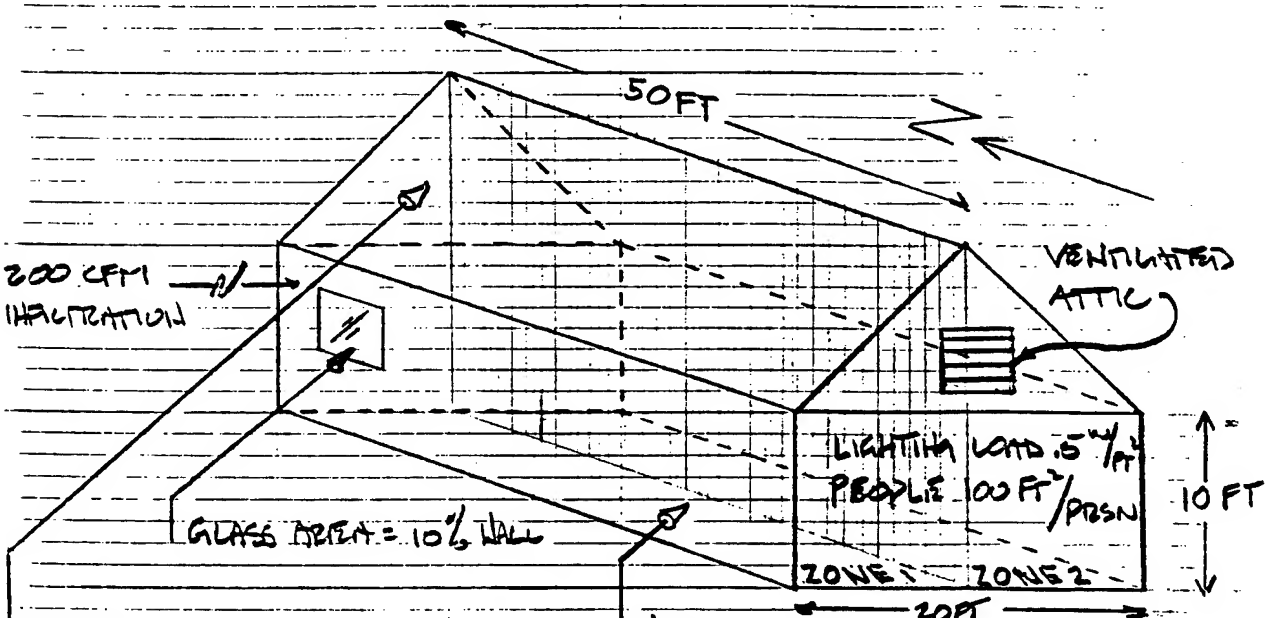
COMPUTED BY RJB
CHECKED BY JIH
DATE AUG 1983
REV. 19

ECO# A-5
INSTALL SOLAR FILM
TRACE 600 ANALYSIS

PROJECT 19-403-10
FAL BEAP

SHEET NO. 7 OF 17 SHEETS

THE FOLLOWING BUILDING WAS MODELED FOR
A REPRESENTATIVE TRACE 600 ANALYSIS



ROOF

W/OINSULATION WITH INSULATION

	R_w	$R_{w/o}$
OUTSIDE AIR	0.25	0.25
BUILTUP ROOF	0.33	0.33
R-19 INSULATION	19	--
AIR SPACE	0.61	0.61
SUSPENDED CLNG	2.38	2.38
INSIDE AIR	0.61	0.61
	23.18	4.18
U =	0.04	0.24

WALL:

	R
OUTSIDE AIR	0.25
WOOD WALL BOARD	0.93
RIGID INSULATION	4
GYP BOARD	0.56
INSIDE AIR	0.68
	6.42

$U = 1/R = 0.16$

FORM 101-1/8

ECO# A-4
ECO# A-3

SHEET 3 OF 13

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************ COOLING COIL PEAK ****************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/18					Mo/Hr: 7/18		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 91/ 68/ 70.0					OADB: 91		OADB: 27		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	1,958		1,958	5.01	0	0.00	0	-1,508	9.47
Glass Solar	18,550	0		18,550	47.42	18,550	56.57	0	0	0.00
Glass Cond	1,523	0		1,523	3.89	1,523	4.64	-6,291	-6,291	39.53
Wall Cond	8,671	2,410		11,081	28.33	8,671	26.44	-6,429	-8,117	51.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	28,744	4,369		33,112	84.65	28,744	87.66	-12,720	-15,916	100.00
Internal Loads										
Lights	1,707	0		1,707	4.36	1,707	5.20	0	0	0.00
People	4,300			4,300	10.99	1,800	5.49	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	6,007	0	0	6,007	15.35	3,506	10.69	0	0	0.00
Ceiling Load	474	-474		0	0.00	540	1.65	-418	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	35,225	3,894	0	39,119	100.00	32,790	100.00	-13,138	-15,916	100.00

---COOLING COIL SELECTION---

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	3.3	39.1	36.6	2,064	76.5	62.9	66.9	60.3	56.6	64.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	3.3	39.1								

---AREAS---

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

---HEATING COIL SELECTION---

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-20.5	2,064	64.7	73.9
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,064	65.0	60.3
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-20.5			

---AIRFLOWS (cfm)---

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	2,064	2,064
Mincfm	0	0
Return	2,064	2,064
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	2.06
Clg Cfm/Ton	633.22
Clg Sqft/Ton	306.76
Clg Btuh/Sqft	39.12
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	2.06
Htg Btuh/SqFt	-20.52

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.3	73.9
Plenum	76.5	64.7
Return	76.5	65.0
Ret/OA	76.5	65.0
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

ECO# A-4
ECO# A-3
ECO# A-5

SHEET 4 OF 13

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/17 * Mo/Hr: 7/17 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 96/ 70/ 70.0 * OADB: 96 * OADB: 27

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	1,944		1,944	5.97	*	0	0.00	*	0	-1,499	10.08
Glass Solar	12,250	0		12,250	37.63	*	12,250	46.44	*	0	0	0.00
Glass Cond	1,283	0		1,283	3.94	*	1,283	4.87	*	-5,253	-5,253	35.35
Wall Cond	8,671	2,395		11,066	34.00	*	8,671	32.87	*	-6,429	-8,107	54.56
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	22,205	4,340		26,544	81.55	*	22,205	84.17	*	-11,682	-14,859	100.00
Internal Loads						*			*			
Lights	1,707	0		1,707	5.24	*	1,707	6.47	*	0	0	0.00
People	4,300			4,300	13.21	*	1,800	6.82	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	6,007	0	0	6,007	18.45	*	3,506	13.29	*	0	0	0.00
Ceiling Load	582	-582		0	0.00	*	668	2.53	*	-516	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	28,793	3,757	0	32,551	100.00	*	26,379	100.00	*	-12,198	-14,859	100.00

------------------------------------COOLING COIL SELECTION------------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	2.7	32.6	30.1	1,602	76.9	63.1	66.9	59.8	56.3	64.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.7	32.6								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-18.3	1,602	64.5	75.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,602	64.8	59.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-18.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	1,602	1,602
Mincfm	0	0
Return	1,602	1,602
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	1.60
Clg Cfm/Ton	590.46
Clg Sqft/Ton	368.66
Clg Btuh/Sqft	32.55
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	1.60
Htg Btuh/SqFt	-18.31

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	59.8	75.0
Plenum	76.8	64.5
Return	76.9	64.8
Ret/OA	76.9	64.8
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY TH
DATE 1913
REV. 19__

ECO# A-5
INSTALL SOLAR FILM
FINANCIAL CALCULATIONS

PROJECT 16-403-10
FT. L EFFEY

SHEET NO. 5 OF 13 SHEETS

COOLING

BASELINE: 39,119

ECO# A-5 32,551 6,568 BTUH/1000 SF

= 6.568 BTUH/SF

ASSUME EER = 10

Δ WATTS = 6.568/10 = .66 WATT/SF

FORM 101-1/8

SHEET 6 OF 13
ECO A-5

Bldg	Area (SF)	Heating Degree Hours	Cooling Degree Hours	Heating Efficiency	Energy Use W/Previous ECO's Electric Kwh/Yr	Energy Use W/Previous ECO's Propane MBTU/Yr	Energy Use W/Previous ECO's Fuel Oil MBTU/Yr	Energy Use W/ECO-A4 Electric Kwh/Yr	Energy Use W/ECO-A4 Propane MBTU/Yr	Energy Use W/ECO-A4 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total
6	1,090	93,192	21,833	66.0%	5,818	44		4,972	23.9	-	846	20.1	0.0	$63	$158	$0	$221
120	9,120	85,120	21,833	66.0%	15,216	768.5											
124	2,001	93,192	21,833	65.0%	12,702	183.2		11,148	145.8	-	1,554	37.4	0.0	$116	$294	$0	$410
127	2,250	85,120	21,833	64.0%	2,783	193.1		1,036	154.1	-	1,747	39.0	0.0	$130	$307	$0	$437
131	998	93,192	21,833	61.0%	5,265	37.3		4,490	17.4	-	775	19.9	0.0	$58	$157	$0	$214
144	7,172	93,192	21,833	67.0%	418	52.5											
156	2,025	11,702	9,003	NA	823												
161	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
162	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
163	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
164	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
165	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
166	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
167	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
177	3,599	60,531	15,420	66.4%	10,869	6.1											
178	3,599	74,412	19,953	65.0%	12,405	63.8											
206	16,768	116,562	21,833	70.8%	108,696		3944.7										
207	27,238	85,120	21,833	71.4%	268,495		1375										
208	26,999	85,120	21,833	72.1%			1375										
229	26,692	85,120	21,833	71.9%	286,764		1375										
230	36,063	85,120	21,833	71.2%	276,379		1375										
240	3,000	60,531	15,420	67.0%	18,805	38.2											
241	10,000	60,531	15,420	66.6%	162,971	153											
243	3,000	60,531	15,420	67.0%	18,805	38.2											
244	3,000	60,531	15,420	67.0%	18,805	38.2											
246	3,000	60,531	15,420	67.0%	18,805	38.2											
247	3,000	60,531	15,420	67.0%	18,805	38.2											
252	12,299	39,883	15,420	73.0%	27,085		919	20,340	-	831.4	6,745	0.0	87.6	$503	$0	$436	$939
286	3,000	60,531	15,420	67.0%	18,805	38.2											
295	41,002	85,120	21,833	58.7%	629,841	1040											
											20,306	289	88	$1,514	$2,275	$436	

SHEET 7 OF 13
ECO A-5

Bldg	Energy Use W/ECO-A3 Electric Kwh/Yr	Energy Use W/ECO-A3 Propane MBTU/Yr	Energy Use W/ECO-A3 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total	Energy Use W/ECO-A5 Electric Kwh/Yr	Energy Use W/ECO-A5 Propane MBTU/Yr	Energy Use W/ECO-A5 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total
6																				
120											10,835			4,381	0	0	$327	$0	$0	$327
124																				
127											1,702			1,061	0	0	$81	$0	$0	$81
131																				
144																				
156																				
161											3,109			763	0	0	$57	$0	$0	$57
162											3,109			763	0	0	$57	$0	$0	$57
163											3,109			763	0	0	$57	$0	$0	$57
164											3,109			763	0	0	$57	$0	$0	$57
165											3,109			763	0	0	$57	$0	$0	$57
166											3,109			763	0	0	$57	$0	$0	$57
167											3,109			763	0	0	$57	$0	$0	$57
177	10,629	5.00	-	240	1	0	$18	$9	$0	$27	9,648			980	0	0	$73	$0	$0	$73
178											10,826			1,580	0	0	$118	$0	$0	$118
206											100,642			8,054	0	0	$600	$0	$0	$600
207											255,412			13,063	0	0	$975	$0	$0	$975
208											255,527			12,968	0	0	$967	$0	$0	$967
229											273,943			12,821	0	0	$956	$0	$0	$956
230											259,057			17,322	0	0	$1,291	$0	$0	$1,291
240											17,787			1,018	0	0	$76	$0	$0	$76
241											162,123			848	0	0	$63	$0	$0	$63
243											17,787			1,018	0	0	$76	$0	$0	$76
244											17,787			1,018	0	0	$76	$0	$0	$76
246											17,787			1,018	0	0	$76	$0	$0	$76
247											17,787			1,018	0	0	$76	$0	$0	$76
252	16,378	-	744	3,982	0	88	$296	$0	$436	$732										
266											17,787			1,018	0	0	$76	$0	$0	$76
295											610,147			19,694	0	0	$1,468	$0	$0	$1,468
				4,202	1	88	$313	$9	$436					104,262	0	0	$7,772	$0	$0	

SHEET 3 OF 13
ECO A-5

Bldg	Energy Use W/ECO-A7			Savings			Savings			
	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6										
120	7,583			3,252	0.0	0.0	$242	$0	$0	$242
124										
127	900			802	0.0	0.0	$60	$0	$0	$60
131										
144										
156										
161	2,542			567	0.0	0.0	$42	$0	$0	$42
162	2,542			567	0.0	0.0	$42	$0	$0	$42
163	2,542			567	0.0	0.0	$42	$0	$0	$42
164	2,542			567	0.0	0.0	$42	$0	$0	$42
165	2,542			567	0.0	0.0	$42	$0	$0	$42
166	2,542			567	0.0	0.0	$42	$0	$0	$42
167	2,542			567	0.0	0.0	$42	$0	$0	$42
177	8,742			906	0.0	0.0	$68	$0	$0	$68
178	9,652			1,173	0.0	0.0	$87	$0	$0	$87
206										
207										
208										
229										
230										
240	17,032			756	0.0	0.0	$56	$0	$0	$56
241	157,060			2,519	0.0	0.0	$188	$0	$0	$188
243	17,032			756	0.0	0.0	$56	$0	$0	$56
244	17,032			756	0.0	0.0	$56	$0	$0	$56
246	17,032			756	0.0	0.0	$56	$0	$0	$56
247	17,032			756	0.0	0.0	$56	$0	$0	$56
252										
286	17,032			756	0.0	0.0	$56	$0	$0	$56
295										
				17,153	0	0	$1,279	0	0	

ECO12 A-5 COST SAVINGS

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 9 Of 13
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO# A-5 (Install Solar Film)	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg 120							
Solar Film	218	SF	$2.28	$497	$2.97	$647	$1,145
Total Bldg 120							$1,145
Bldg 127							
Solar Film	165	SF	$2.28	$376	$2.97	$490	$866
Total Bldg 127							$866
Bldg 161-167 (EA)							
Solar Film	200	SF	$2.28	$456	$2.97	$594	$1,050
Total Bldg 161-167 (EA)							$1,050
Bldg 177							
Solar Film	355	SF	$2.28	$809	$2.97	$1,054	$1,864
Total Bldg 177							$1,864
Bldg 178							
Solar Film	355	SF	$2.28	$809	$2.97	$1,054	$1,864
Total Bldg 178							$1,864
Bldg 206							
Solar Film	1200	SF	$2.28	$2,736	$2.97	$3,564	$6,300
Total Bldg 206							$6,300
Bldg 207							
Solar Film	1200	SF	$2.28	$2,736	$2.97	$3,564	$6,300
Total Bldg 207							$6,300
Bldg 208							
Solar Film	1200	SF	$2.28	$2,736	$2.97	$3,564	$6,300
Total Bldg 208							$6,300

ECO13 A-5 COST SAVINGS

CONSTRUCTION COST ESTIMATE				Date Prepared: February 1993		Sheet 10 Of 13	
Project: EEAP Limited Energy Study				Project No.	Basis for Estimate: Code A (no design competed)		
Location: Fort Hunter-Liggett, California							
Engineer-Architect: Keller & Gannon							
Drawing No.: ECO# A-5 (Install Solar Film)		Estimator: RJB			Checked By: BIH		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Bldg 229							
Solar Film	1200	SF	$2.28	$2,736	$2.97	$3,564	$6,300
Total Bldg 229							$6,300
Bldg 230							
Solar Film	1200	SF	$2.28	$2,736	$2.97	$3,564	$6,300
Total Bldg 230							$6,300
Bldg 240							
Solar Film	240	SF	$2.28	$547	$2.97	$713	$1,260
Total Bldg 240							$1,260
Bldg 241							
Solar Film	56	SF	$2.28	$128	$2.97	$166	$294
Total Bldg 241							$294
Bldg 243							
Solar Film	240	SF	$2.28	$547	$2.97	$713	$1,260
Total Bldg 243							$1,260
Bldg 244							
Solar Film	240	SF	$2.28	$547	$2.97	$713	$1,260
Total Bldg 244							$1,260
Bldg 246							
Solar Film	240	SF	$2.28	$547	$2.97	$713	$1,260
Total Bldg 246							$1,260
Bldg 247							
Solar Film	240	SF	$2.28	$547	$2.97	$713	$1,260
Total Bldg 247							$1,260

ECO14 A-5 COST SAVINGS

CONSTRUCTION COST ESTIMATE					Date Prepared February 1993		Sheet 11 Of 13	
Project: EEAP Limited Energy Study					Project No.		Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California								
Engineer-Architect: Keller & Gannon								
Drawing No.: ECO# A-5 (Install Solar Film)			Estimator: RJB				Checked By: BIH	

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Bldg 286							
Solar Film	240	SF	$2.28	$547	$2.97	$713	$1,260
Total Bldg 286							$1,260
Bldg 295							
Solar Film	2866	SF	$2.28	$6,534	$2.97	$8,512	$15,047
Total Bldg 295							$15,047

SHEET 12 OF 13
ECO A-5

ECO21 A-5 COST SAVINGS

Building	Construction Cost	O&M/YR	Total	Sales Tax	OH & P	Bond	Contingency	Savings	SIR
120	$1,145	$0	$1,145	$1,237	$1,608	$1,624	$1,786	$1,455	0.8
127	$866	$0	$866	$935	$1,216	$1,228	$1,351	$360	0.3
161	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
162	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
163	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
164	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
165	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
166	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
167	$1,050	$0	$1,050	$1,134	$1,474	$1,489	$1,638	$253	0.2
177	$1,864	$0	$1,864	$2,013	$2,617	$2,643	$2,908	$325	0.1
178	$1,864	$0	$1,864	$2,013	$2,617	$2,643	$2,908	$525	0.2
206	$6,300	$0	$6,300	$6,804	$8,845	$8,934	$9,827	$2,670	0.3
207	$6,300	$0	$6,300	$6,804	$8,845	$8,934	$9,827	$4,338	0.4
208	$6,300	$0	$6,300	$6,804	$8,845	$8,934	$9,827	$4,303	0.4
229	$6,300	$0	$6,300	$6,804	$8,845	$8,934	$9,827	$4,254	0.4
230	$6,300	$0	$6,300	$6,804	$8,845	$8,934	$9,827	$5,745	0.6
240	$1,260	$0	$1,260	$1,361	$1,769	$1,787	$1,965	$338	0.2
241	$294	$0	$294	$318	$413	$417	$459	$280	0.6
243	$1,260	$0	$1,260	$1,361	$1,769	$1,787	$1,965	$338	0.2
244	$1,260	$0	$1,260	$1,361	$1,769	$1,787	$1,965	$338	0.2
246	$1,260	$0	$1,260	$1,361	$1,769	$1,787	$1,965	$338	0.2
247	$1,260	$0	$1,260	$1,361	$1,769	$1,787	$1,965	$338	0.2
286	$1,260	$0	$1,260	$1,361	$1,769	$1,787	$1,965	$338	0.2
295	$15,047	$0	$15,047	$16,251	$21,126	$21,337	$23,471	$6,533	0.3

Construction Cost....Installed Cost
O&M/YR..................Yearly maintenance scheduled as 2.5% of installed cost
Sales Tax..................8% of total
OH & P......................Contractors overhead and profit 30%
Bond..........................1%
Contingency............Estimators contingency 10%
Savings....................Yearly savings multiplied by UPW factor for 5 years (4.45)
SIR.............................Savings/(Cost+Maint*UPW)

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO A-5
Sheet 13 of 13

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Fiscal Year FY96
Project Title: Install Solar Film
Discrete Portion Name: ECO# A-5
Analysis Date: March 1993
Economic Life: 5 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$105,275		
B. SIOH	$5,790		
C. Design Cost	$6,317		
D. Total Cost (1A+1B+1C)	$117,382		
E. Salvage Value of Existing Equipment			
F. Public Utility Company Rebate			
G. Total Investment (1D-1E-1F)			$117,382

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	355.0	$7,753	4.49	$34,812
B. Dist	$4.98		$0	4.77	$0
C. Propane	$7.87		$0	4.79	$0
D. Other					
E. Demand Savings					
F. Total			$7,753		$34,812

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		4.45	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Sav-ings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	15.1 Years
5. Total Net Discounted Savings (2F5+3C):	$34,812
6. Savings to Investment Ratio (SIR) 5/1G:	0.30
7. Adjusted Internal Rate of Return (AIRR):	-28.30%

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H
CHECKED BY
DATE MARCH 1993
REV. 19

ECO A6
REDUCE GLASS AREA

PROJECT 16-403-10
FHL - EEAP

SHEET NO. 1 OF 1 SHEETS

DESCRIPTION OF ACTION

Reducing building wall glass area improves the overall wall thermal characteristics. Heating and cooling energy use are reduced because walls replacing window areas will have a U value of about 0.06 while the glass being replaced has a U value of about 0.75 to 1.1. Solar gain is also reduced, saving additional energy during the cooling season.

BUILDINGS INCLUDED

No buildings at FHL are seen to have excessive glass areas, thus, this ECO is not evaluated.

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY BIH	ECO A7	PROJECT 16-403-10
CHECKED BY	Install Shading	FTL F-EAP
DATE MARCH 1993	Devices	
REV. 19		SHEET NO. 1 OF 13 SHEETS

Description of Action

Shading devices installed to keep windows, doors and/or wall sections in shade during summer day-times will reduce the amount of solar heat gain, and, thus, the amount of energy needed to provide space cooling.

BUILDINGS INCLUDED

The following buildings were identified during field investigations:

120	Fire Station / dormatory
127	BOQ
161–167	Admin Buildings
177	Tech. Library
178	Child Development Center
240, 235, 236, 237, 243, 244, 246, 247, 286	Admin Bldgs.
241	GM Facility.

ENERGY SAVINGS

Energy Savings for shading these buildings are based on TRACE-600 runs of a typical structure and then factored to each of the above buildings based on window areas in conditioned spaces.

FORM 101-1/8

Keller & Gannon
Engineers–Architects

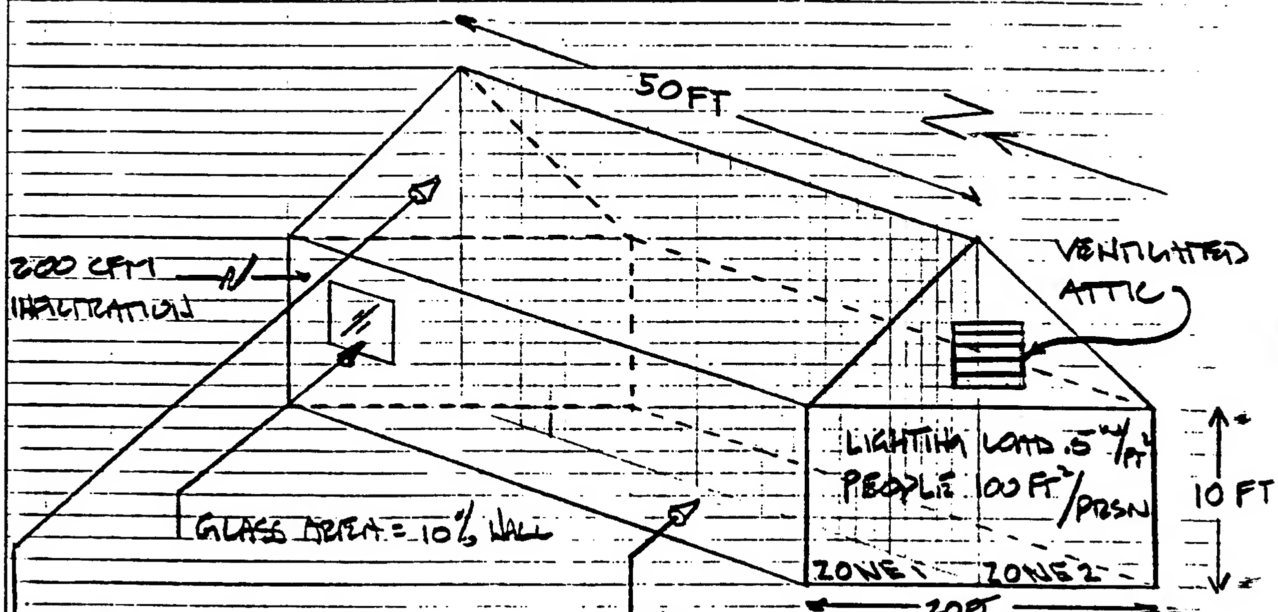
COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY BJH
DATE MARCH 1993
REV. 19__

ECO# 4-7
INSTALL SHADING DEVICES
TRANE 600 ANALYSIS

PROJECT 13-403-10
FtL FEAP
SHEET NO. 7 OF 7 SHEETS

THE FOLLOWING BUILDING WAS MODELED FOR A REPRESENTATIVE TRANE 600 ANALYSIS



ROOF

W/O INSULATION WITH INSULATION

	R_w	$R_{w/o}$
OUTSIDE AIR	0.25	0.25
BUILTUP ROOF	0.33	0.33
R=19 INSULATION	19	—
AIR SPACE	0.61	0.61
SUSPENDED CLNG	2.38	2.38
INSIDE AIR	0.61	0.61
	23.78	4.18
U =	0.04	0.24

WALL:

	R
OUTSIDE AIR	0.25
WOOD WALLBOARD	0.93
RIGID INSULATION	4
GYP BOARD	0.56
INSIDE AIR	0.68
	6.42

U = 1/R = 0.16

FORM 101-1/8

ECO# A-4
ECO# A-3
ECO# A-5

SHEET 3 OF 13
ECO A-7

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/17 * Mo/Hr: 7/17 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 96/ 70/ 70.0 * OADB: 96 * OADB: 27

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	1,944		1,944	5.97	*	0	0.00	*	0	-1,499	10.08
Glass Solar	12,250	0		12,250	37.63	*	12,250	46.44	*	0	0	0.00
Glass Cond	1,283	0		1,283	3.94	*	1,283	4.87	*	-5,253	-5,253	35.35
Wall Cond	8,671	2,395		11,066	34.00	*	8,671	32.87	*	-6,429	-8,107	54.56
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	22,205	4,340		26,544	81.55	*	22,205	84.17	*	-11,682	-14,859	100.00
Internal Loads						*			*			
Lights	1,707	0		1,707	5.24	*	1,707	6.47	*	0	0	0.00
People	4,300			4,300	13.21	*	1,800	6.82	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	6,007	0	0	6,007	18.45	*	3,506	13.29	*	0	0	0.00
Ceiling Load	582	-582		0	0.00	*	668	2.53	*	-516	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	28,793	3,757	0	32,551	100.00	*	26,379	100.00	*	-12,198	-14,859	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	2.7	32.6	30.1	1,602	76.9	63.1	66.9	59.8	56.3	64.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.7	32.6								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-18.3	1,602	64.5	75.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,602	64.8	59.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-18.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	1,602	1,602
Mincfm	0	0
Return	1,602	1,602
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/SqFt	1.60
Clg Cfm/Ton	590.46
Clg SqFt/Ton	368.66
Clg Btuh/SqFt	32.55
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	1.60
Htg Btuh/SqFt	-18.31

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	59.8	75.0
Plenum	76.8	64.5
Return	76.9	64.8
Ret/OA	76.9	64.8
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

ECO# A-4
ECO# A-3
ECO# A-5
ECO# A-7 - SHEET 4 of 13
ECO# A-7

System 1 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>	Mo/Hr: 7/17					*	Mo/Hr: 7/17		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 96/ 70/ 70.0					*	OADB: 96		*	OADB: 27		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	2,608		2,608	9.41	*	0	0.00	*	0	-1,494	9.40
Glass Solar	4,970	0		4,970	17.92	*	5,600	26.45	*	0	0	0.00
Glass Cond	2,421	0		2,421	8.73	*	2,002	9.45	*	-6,291	-6,291	39.60
Wall Cond	9,228	2,495		11,723	42.28	*	9,149	43.22	*	-6,429	-8,102	51.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	16,618	5,103		21,722	78.34	*	16,751	79.12	*	-12,720	-15,887	100.00
Internal Loads						*			*			
Lights	1,707	0		1,707	6.15	*	1,707	8.06	*	0	0	0.00
People	4,300			4,300	15.51	*	1,800	8.50	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	6,007	0	0	6,007	21.66	*	3,506	16.56	*	0	0	0.00
Ceiling Load	998	-998		0	0.00	*	913	4.31	*	-635	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	23,622	4,106	0	27,728	100.00	*	21,170	100.00	*	-13,355	-15,887	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	2.3	27.7	25.2	1,230	78.1	63.5	66.9	59.1	56.0	64.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.3	27.7								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	1,000		
Part	0		
ExFlr	0		
Roof	1,000	0	0
Wall	1,400	140	10

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-18.3	1,230	64.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,230	64.7	59.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-18.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	1,230	1,230
Mincfm	0	0
Return	1,230	1,230
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	1.23
Clg Cfm/Ton	532.33
Clg Sqft/Ton	432.77
Clg Btuh/Sqft	27.73
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	1.23
Htg Btuh/SqFt	-18.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	59.1	78.0
Plenum	78.1	64.3
Return	78.1	64.7
Ret/OA	78.1	64.7
Runarnd	75.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY TJH
DATE MARCH 1993
REV. 19

ECO# A-7
INSTALL SHADING DEVICES
ENERGY CALCULATIONS

PROJECT 16-403-10
FT. EEAP

SHEET NO. 5 OF 13 SHEETS

COOLING:

BASELINE	32551		
ECO# A-7	27723	BTUH	4,892 BTUH/1000 SF

= 4.892 BTUH/SF

ASSUME EER = 10

Δ WATTS = 4.892/10 = .49 WATT/SF

FORM 101-1/8

Bldg	Energy Use W/ECO-A7			Savings			Savings			
	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6										
120	7,583			3,252	0.0	0.0	$242	$0	$0	$242
124										
127	900			802	0.0	0.0	$60	$0	$0	$60
131										
144										
156										
161	2,542			567	0.0	0.0	$42	$0	$0	$42
162	2,542			567	0.0	0.0	$42	$0	$0	$42
163	2,542			567	0.0	0.0	$42	$0	$0	$42
164	2,542			567	0.0	0.0	$42	$0	$0	$42
165	2,542			567	0.0	0.0	$42	$0	$0	$42
166	2,542			567	0.0	0.0	$42	$0	$0	$42
167	2,542			567	0.0	0.0	$42	$0	$0	$42
177	8,742			906	0.0	0.0	$68	$0	$0	$68
178	9,652			1,173	0.0	0.0	$87	$0	$0	$87
206										
207										
208										
229										
230										
240	17,032			756	0.0	0.0	$56	$0	$0	$56
241	157,060			2,519	0.0	0.0	$188	$0	$0	$188
243	17,032			756	0.0	0.0	$56	$0	$0	$56
244	17,032			756	0.0	0.0	$56	$0	$0	$56
246	17,032			756	0.0	0.0	$56	$0	$0	$56
247	17,032			756	0.0	0.0	$56	$0	$0	$56
252										
286	17,032			756	0.0	0.0	$56	$0	$0	$56
295										
				17,153	0	0	$1,279	0	0	

SHEET 6 OF 13

SHEET 7 OF 13
ECO A-7

Bldg	Area (SF)	Heating Degree Hours	Cooling Degree Hours	Heating Efficiency	Energy Use W/Previous ECO's Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Energy Use W/ECO-A4 Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Savings Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6	1,090	93,192	21,833	66.0%	5,818	44		4,972	23.9	-	846	20.1	0.0	$63	$158	$0	$221
120	9,120	85,120	21,833	66.0%	15,216	766.5											
124	2,001	93,192	21,833	65.0%	12,702	183.2		11,148	145.8	-	1,554	37.4	0.0	$116	$294	$0	$410
127	2,250	85,120	21,833	64.0%	2,783	193.1		1,036	154.1	-	1,747	39.0	0.0	$130	$307	$0	$437
131	998	93,192	21,833	61.0%	5,265	37.3		4,490	17.4	-	775	19.9	0.0	$58	$157	$0	$214
144	7,172	93,192	21,833	67.0%	418	52.5											
156	2,025	11,702	9,003	NA	823												
161	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
162	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
163	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
164	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
165	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
166	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
167	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3	-	1,234	24.7	0.0	$92	$194	$0	$286
177	3,599	60,531	15,420	66.4%	10,869	6.1											
178	3,599	74,412	19,953	65.0%	12,405	63.8											
206	16,768	116,562	21,833	70.8%	108,696		3944.7										
207	27,238	85,120	21,833	71.4%	268,495		1375										
208	26,999	85,120	21,833	72.1%			1375										
229	26,692	85,120	21,833	71.9%	286,764		1375										
230	36,063	85,120	21,833	71.2%	276,379		1375										
240	3,000	60,531	15,420	67.0%	18,805	38.2											
241	10,000	60,531	15,420	66.6%	162,971	153											
243	3,000	60,531	15,420	67.0%	18,805	38.2											
244	3,000	60,531	15,420	67.0%	18,805	38.2											
246	3,000	60,531	15,420	67.0%	18,805	38.2											
247	3,000	60,531	15,420	67.0%	18,805	38.2											
252	12,299	39,883	15,420	73.0%	27,085		919	20,340	-	831.4	6,745	0.0	87.6	$503	$0	$436	$939
286	3,000	60,531	15,420	67.0%	18,805	38.2											
295	41,002	85,120	21,833	58.7%	629,841	1040											
											20,306	289	88	$1,514	$2,275	$436	

SHEET 8 OF 13
ECO A-7

Bldg	Energy Use W/ECO-A3 Electric Kwh/Yr	Energy Use W/ECO-A3 Propane MBTU/Yr	Energy Use W/ECO-A3 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total	Energy Use W/ECO-A5 Electric Kwh/Yr	Energy Use W/ECO-A5 Propane MBTU/Yr	Energy Use W/ECO-A5 Fuel Oil MBTU/Yr	Savings Electric Kwh/Yr	Savings Propane MBTU/Yr	Savings Fuel Oil MBTU/Yr	Savings Electric $/YR	Savings Propane $/YR	Savings Fuel Oil $/YR	Total
6																				
120											10,835			4,381	0	0	$327	$0	$0	$327
124																				
127											1,702			1,081	0	0	$81	$0	$0	$81
131																				
144																				
156																				
161											3,109			763	0	0	$57	$0	$0	$57
162											3,109			763	0	0	$57	$0	$0	$57
163											3,109			763	0	0	$57	$0	$0	$57
164											3,109			763	0	0	$57	$0	$0	$57
165											3,109			763	0	0	$57	$0	$0	$57
166											3,109			763	0	0	$57	$0	$0	$57
167											3,109			763	0	0	$57	$0	$0	$57
177	10,629	5.00	-	240	1	0	$18	$9	$0	$27	9,648			980	0	0	$73	$0	$0	$73
178											10,825			1,580	0	0	$118	$0	$0	$118
206											100,642			8,054	0	0	$600	$0	$0	$600
207											255,412			13,083	0	0	$975	$0	$0	$975
208											255,527			12,968	0	0	$967	$0	$0	$967
229											273,943			12,821	0	0	$956	$0	$0	$956
230											259,057			17,322	0	0	$1,291	$0	$0	$1,291
240											17,787			1,018	0	0	$76	$0	$0	$76
241											162,123			848	0	0	$63	$0	$0	$63
243											17,787			1,018	0	0	$76	$0	$0	$76
244											17,787			1,018	0	0	$76	$0	$0	$76
246											17,787			1,018	0	0	$76	$0	$0	$76
247											17,787			1,018	0	0	$76	$0	$0	$76
252	16,378	-	744	3,962	0	88	$296	$0	$436	$732										
286											17,787			1,018	0	0	$76	$0	$0	$76
295											610,147			19,694	0	0	$1,468	$0	$0	$1,468
				4,202	1	88	$313	$9	$436					104,262	0	0	$7,772	$0	$0	

Bldg	Energy Use W/ECO-A7			Savings			Savings			
	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric Kwh/Yr	Propane MBTU/Yr	Fuel Oil MBTU/Yr	Electric $/YR	Propane $/YR	Fuel Oil $/YR	Total
6										
120	7,583			3,252	0.0	0.0	$242	$0	$0	$242
124										
127	900			802	0.0	0.0	$60	$0	$0	$60
131										
144										
156										
161	2,542			567	0.0	0.0	$42	$0	$0	$42
162	2,542			567	0.0	0.0	$42	$0	$0	$42
163	2,542			567	0.0	0.0	$42	$0	$0	$42
164	2,542			567	0.0	0.0	$42	$0	$0	$42
165	2,542			567	0.0	0.0	$42	$0	$0	$42
166	2,542			567	0.0	0.0	$42	$0	$0	$42
167	2,542			567	0.0	0.0	$42	$0	$0	$42
177	8,742			906	0.0	0.0	$68	$0	$0	$68
178	9,652			1,173	0.0	0.0	$87	$0	$0	$87
206										
207										
208										
229										
230										
240	17,032			756	0.0	0.0	$56	$0	$0	$56
241	161,493			630	0.0	0.0	$47	$0	$0	$47
243	17,032			756	0.0	0.0	$56	$0	$0	$56
244	17,032			756	0.0	0.0	$56	$0	$0	$56
246	17,032			756	0.0	0.0	$56	$0	$0	$56
247	17,032			756	0.0	0.0	$56	$0	$0	$56
252										
286	17,032			756	0.0	0.0	$56	$0	$0	$56
295										
				15,264	0	0	$1,138	0	0	

SHEET 3 OF 13

FECO A-7

ECO23 A-7 COST SAVINGS

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 10 Of 13

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO# A-7 (INSTALL SHADING DEVICES)

Estimator: RJB

Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
BLDG120							
Indoor Blinds	218	SF	$0.52	$113	$6	$1,282	$1,395
Total Bldg 120							$1,395
BLDG 127							
Indoor Blinds	165	SF	$0.52	$86	$6	$970	$1,056
Total Bldg 120							$1,056
BLDG 161-162							
Indoor Blinds	200	SF	$0.52	$104	$6	$1,176	$1,280
Total Bldg 161-162							$1,280
BLDG 177							
Indoor Blinds	355	SF	$0.52	$185	$6	$2,087	$2,272
Total Bldg 355							$2,272
BLDG 178							
Indoor Blinds	355	SF	$0.52	$185	$6	$2,087	$2,272
Total Bldg 178							$2,272
BLDG 240							
Indoor Blinds	240	SF	$0.52	$125	$6	$1,411	$1,536
Total Bldg 240							$1,536
BLDG 241							
Indoor Blinds	56	SF	$0.52	$29	$6	$329	$358
Total Bldg 241							$358

ECO24 A-7 COST SAVINGS

CONSTRUCTION COST ESTIMATE								Date Prepared: February 1993	Sheet 11 Of 13
Project: EEAP Limited Energy Study							Project No.	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California									
Engineer-Architect: Keller & Gannon									
Drawing No.: ECO# A-7 (INSTALL SHADING DEVICES)			Estimator: RJB				Checked By: BIH		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
BLDG 243							
Indoor Blinds	240	SF	$0.52	$125	$6	$1,411	$1,536
Total Bldg 243							$1,536
BLDG 244							
Indoor Blinds	240	SF	$0.52	$125	$6	$1,411	$1,536
Total Bldg 244							$1,536
BLDG 246							
Indoor Blinds	240	SF	$0.52	$125	$6	$1,411	$1,536
Total Bldg 246							$1,536
BLDG 247							
Indoor Blinds	240	SF	$0.52	$125	$6	$1,411	$1,536
Total Bldg 247							$1,536
BLDG 286							
Indoor Blinds	240	SF	$0.52	$125	$6	$1,411	$1,536
Total Bldg 286							$1,536

ECO A-7 COST SAVINGS

Building	Construction	O&M/YR	Total	Sales Tax	OH & P	Bond	Contingency	Savings	SIR
120	$1,395	$0	$1,395	$1,507	$1,959	$1,978	$2,176	$1,076	0.5
127	$1,056	$0	$1,056	$1,140	$1,483	$1,497	$1,647	$267	0.2
161	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
162	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
163	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
164	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
165	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
166	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
167	$1,280	$0	$1,280	$1,382	$1,797	$1,815	$1,997	$186	0.1
177	$2,272	$0	$2,272	$2,454	$3,190	$3,222	$3,544	$303	0.1
178	$2,272	$0	$2,272	$2,454	$3,190	$3,222	$3,544	$387	0.1
240	$1,536	$0	$1,536	$1,659	$2,157	$2,178	$2,396	$249	0.1
241	$358	$0	$358	$387	$503	$508	$558	$209	0.4
243	$1,536	$0	$1,536	$1,659	$2,157	$2,178	$2,396	$249	0.1
244	$1,536	$0	$1,536	$1,659	$2,157	$2,178	$2,396	$249	0.1
246	$1,536	$0	$1,536	$1,659	$2,157	$2,178	$2,396	$249	0.1
247	$1,536	$0	$1,536	$1,659	$2,157	$2,178	$2,396	$249	0.1
286	$1,536	$0	$1,536	$1,659	$2,157	$2,178	$2,396	$249	0.1

Construction Cost....Installed Cost
O&M/YR..................Yearly maintenance scheduled as 2.5% of installed cost
Sales Tax..................8% of total
OH & P.....................Contractors overhead and profit 30%
Bond.........................1%
Contingency............Estimators contingency 10%
Savings...................Yearly savings multiplied by UPW factor for 5 years (4.45)
SIR............................Savings/(Cost+Maint*UPW)

SHEET 12 OF 13
ECO # A-7

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: Install Shading Devices — Fiscal Year FY96
Discrete Portion Name: ECO# A-7
Analysis Date: March 1993 — Economic Life: 5 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$18,306		
B. SIOH	$1,007		
C. Design Cost	$1,098		
D. Total Cost (1A+1B+1C)	$20,411		
E. Salvage Value of Existing Equipment			
F. Public Utility Company Rebate			
G. Total Investment (1D-1E-1F)			$20,411

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	17.0	$371	4.49	$1,667
B. Dist	$4.98		$0	4.77	$0
C. Propane	$7.87		$0	4.79	$0
D. Other					
E. Demand Savings					
F. Total			$371		$1,667

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($286)		
(1) Discount Factor (Table A)		4.45	
(2) Discounted Savings/Cost (3A x 3A1)			($1,273)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) — ($1,273)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	239.3	Years
5. Total Net Discounted Savings (2F5+3C):	$394	
6. Savings to Investment Ratio (SIR) 5/1G:	0.02	
7. Adjusted Internal Rate of Return (AIRR):	-63.45%	

COMPUTATION SHEET

KELLER & GANNON
Engineers & Architects
Quality Services Since 1941

COMPUTED BY B/H
CHECKED BY
DATE JUNE 1993
REV. 19__

ECO # B-1
DUTY CYCLING
ADDENDUM

PROJECT 16-403-10
FHL EEAP

SHEET NO. 1 OF 5 SHEETS

RESPONSE TO REVIEW COMMENT: FORSCOM EEAP REVIEW COMMENTS DATED 4/2/93, NARESH KAPUR, PE, FCEN-RDF, COMMENT NO. 12.

OTHER BUILDINGS WITHIN LIST OF SIGNIFICANT ENERGY USING BLDGS ARE CONSIDERED; BUILDINGS CONSIDERED:

101	HACIENDA	-	CONTROL ELEC. RES. HTR.S.
120	FIRE STATION	-	CONTROL EAST SIDE AHU FAN
161	ADMIN. BLDGS	-	CONTROL AHU FANS
162	—— // ——	-	—— // ——
163	—— // ——	-	—— // ——
164	—— // ——	-	—— // ——
165	—— // ——	-	—— // ——
166	—— // ——	-	—— // ——
167	—— // ——	-	—— // ——
177	TECH. LIBRARY	-	—— // ——
178	CHILD. DEV. CNTR	-	—— // ——
182	COMMISSARY	-	—— // ——
190	CHAPEL	-	—— // ——
197	ADMIN BLDG R&D	-	—— // ——
209	SNACK BAR	-	—— // ——
210	CLINIC	-	—— // ——
211	SWIMMING POOL	-	CONTROL CIRC PUMP(S)
212	GYMNASIUM	-	CONTROL AHU FANS
235	ADMIN. BLDGS.	-	—— // ——
236	//	-	—— // ——
237	//	-	—— // ——
238	//	-	—— // ——
240	//	-	—— // ——
241	GM FACILITY	-	—— // ——
243	ADMIN. BLDG.	-	—— // ——
244	//	-	—— // ——
246	//	-	—— // ——
247	//	-	—— // ——

COMPUTATION SHEET

KELLER & GANNON
Engineers & Architects
Quality Services Since 1941

COMPUTED BY B/H	ECO # B-1	PROJECT 16-403-10
CHECKED BY	DUTY CYCLING	FHL EEAP
DATE JUNE 1993	ADDENDUM	
REV. 19		SHEET NO. 2 OF 5 SHEETS

BUILDINGS CONSIDERED, CONTINUED:

252	VEHICLE MAINT. SHOP	- CONTROL HW CIRC PUMP
256	"	- "
259	"	- "
286	ADMIN. BLDG.	- CONTROL HVAC FANS
287	REC. CENTER	- "
288	GEN. PURP. WHSE.	- "
290	ELECTRONIC EQUIP. FAC	- "
291	CONT. HUMID. WHSE	- "
301	ADP BUILDING	- "

ONLY THOSE MOTORS & OTHER ELECTRIC LOADS WHICH ARE CONTINUOUS OR ARE USED DURING PEAK ELECTRICAL USE PERIODS ARE CONSIDERED.

IN MOST CASES, LOADS INCLUDE ONLY THE FAN FOR HVAC SUPPLY/RETURN AIR. IT IS NOT PROPOSED TO CONTROL COMPRESSORS ON THESE SIMPLE ROOF-TOP TYPE UNITS. THE FOLLOWING TABLES INDICATE ENERGY & COST SAVINGS. BASIS ASSUMES LOADS TURNED OFF 10MIN EVERY HOUR.

FORM 101-1/8

SHEET 3 OF 5

ECO B-1 (Duty Cycling) Cost Savings (Addendum June 1993)

Building	Item to be Controlled	No. Ea.	HP	Mtr Eff	KW	Total kW	New kW	Demand kW Saved	Demand $/Yr	Demand $LCC	Invest $	Simple Payback	SIR (2)
101	Elec Res Heaters (1)	1	-	100%	58.0	58.0	48.3	9.67	$1,044	$12,215	$2,619	2.51	4.66
120	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
161	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
162	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
163	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
164	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
165	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
166	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
167	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
177	Fan Coil Unit SA Fan	1	7.50	85%	6.58	6.6	5.5	1.10	$118	$1,386	$2,619	22.10	0.53
178	Fan Coil Unit SA Fan	2	1.00	83%	0.90	1.8	1.5	0.30	$32	$379	$2,619	80.93	0.14
182	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
190	Fan Coil Unit SA Fan	1	0.75	83%	0.67	0.7	0.6	0.11	$12				
	Fan Coil Unit RA Fan	1	1.00	83%	0.90	0.9	0.7	0.15	$16				
							Total	0.26	$28	$331	$2,619	92.49	0.13
197	Fan Coil Unit SA Fan	1	5.00	83%	4.49	4.5	3.7	0.75	$81				
	Fan Coil Unit RA Fan	1	1.00	83%	0.90	0.9	0.7	0.15	$16				
							Total	0.90	$97	$1,136	$2,619	26.98	0.43
209	Fan Coil Unit SA Fan	1	5.00	83%	4.49	4.5	3.7	0.75	$81	$946	$2,619	32.37	0.36
210	Fan Coil Unit SA Fan	1	10.00	85%	8.78	8.8	7.3	1.46	$158				
	Fan Coil Unit RA Fan	1	5.00	83%	4.49	4.5	3.7	0.75	$81				
							Total	2.21	$239	$2,795	$2,619	10.96	1.07
211	HW Circulation Pumps	1	10.00	87.5%	10.00	10.0	8.3	1.67	$180	$2,106	$2,619	14.55	0.80
212	Fan Coil Unit SA Fan	1	0.75	83%	0.67	0.7	0.6	0.11	$12	$142	$2,619	215.82	0.05
235	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
236	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
237	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
238	Fan Coil Unit SA Fan	1	20.00	87%	17.15	17.1	14.3	2.86	$309				
	Fan Coil Unit RA Fan	1	7.50	83%	6.74	6.7	5.6	1.12	$121				
							Total	3.98	$430	$5,031	$2,619	6.09	1.92
240	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11

ECO B-1 (Duty Cycling) Cost Savings (Addendum June 1993)

Building	Item to be Controlled	No. Ea.	HP	Mtr Eff	KW	Total kW	New kW	Demand kW Saved	Demand $/Yr	Demand $LCC	Invest $	Simple Payback	SIR (2)
241	Fan Coil Unit SA Fan	1	2.00	83%	1.8	1.8	1.5	0.30	$32				
	Fan Coil Unit RA Fan	1	1.00	83%	0.90	0.9	0.7	0.15	$16				
							Total	0.45	$49	$568	$2,619	53.95	0.22
243	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
244	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
246	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
247	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
252	HW Circulation Pumps	1	0.75	83%	0.67	0.7	0.6	0.11	$12	$142	$2,619	215.82	0.05
256	HW Circulation Pumps	1	0.75	83%	0.67	0.7	0.6	0.11	$12	$142	$2,619	215.82	0.05
259	HW Circulation Pumps	1	0.75	83%	0.67	0.7	0.6	0.11	$12	$142	$2,619	215.82	0.05
286	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
287	Fan Coil Unit SA Fan	1	5.00	85%	4.39	4.4	3.7	0.73	$79				
	Fan Coil Unit RA Fan	1	3.00	83%	2.70	2.7	2.2	0.45	$49				
							Total	1.18	$128	$1,492	$2,619	20.53	0.57
288	Fan Coil Unit SA Fan	2	0.75	83%	0.67	1.3	1.1	0.22	$24	$284	$2,619	107.91	0.11
290	Fan Coil Unit SA Fan	2	-	-	1.33	2.7	2.2	0.44	$48	$562	$2,619	54.53	0.21
291	Fan Coil Unit SA Fan	2	-	-	4.78	9.6	8.0	1.59	$172	$2,014	$2,619	15.22	0.77
301	Fan Coil Unit SA Fan	1	15.00	85%	13.16	13.2	11.0	2.19	$237				
	Fan Coil Unit RA Fan	1	3.00	83%	2.70	2.7	2.2	0.45	$49				
							Total	2.64	$285	$3,340	$2,619	9.17	1.28
Summary of 'Added' Building Analysis Factors													
101	Elec Res Heaters (1)	1	-	100%	58.0	58.0	48.3	9.67	$1,044	$12,215	$2,619	2.51	4.66
210	HVAC Unit SA & RA Fa						Total	2.21	$239	$2,795	$2,619	10.96	1.07
238	HVAC Unit SA & RA Fa						Total	3.98	$430	$5,031	$2,619	6.09	1.92
301	HVAC Unit SA & RA Fa						Total	2.64	$285	$3,340	$2,619	9.17	1.28
Total								18.50	$1,998	$23,381	$10,475	5.24	2.23

NOTES:
1. Hacienda has 90 kW connected load of 3 kW electric resistance space heaters. Assume that 60% are left on during the day, and assumes a 90% room occupancy rate. (The Hacienda is usually filled year-round.) Thus, load is 90 x .60 x .90 = 58 kW.
2. Simple payback period and SIR calculations above do not include added O&M costs; refer to ECIP Analysis Sheet for complete

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California | Region No. 4 | Project No. 16-403-10
Project Title: Duty Cycling | Fiscal Year FY96
Discrete Portion Name: ECO# B-1
Analysis Date: June 1993 | Economic Life: 15 YEARS | Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$23,710		
B. SIOH	$1,304		
C. Design Cost	$1,423		
D. Total Cost (1A+1B+1C)	$26,437		
E. Salvage Value of Existing Equipment			
F. Public Utility Company Rebate		$250	
G. Total Investment (1D-1E-1F)			$26,187

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84		$0	11.70	$0
B. Dist	$4.98		$0	13.78	$0
C. Propane	$7.87		$0	14.16	$0
D. Other					
E. Demand @ $108/kW-Yr		130.8	$14,122	11.70	$165,227
F. Total			$14,122		$165,227

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($667)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($7,413)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Sav-ings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) ($7,413)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 1.9 Years
5. Total Net Discounted Savings (2F5+3C): $157,814
6. Savings to Investment Ratio (SIR) 5/1G: 6.03
7. Adjusted Internal Rate of Return (AIRR): 53.80%

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY BHH
DATE FEB 1993
REV. 19__

ECO# B-2
SHADE CONDENSER FROM SUN
PROJECT DESCRIPTION

PROJECT 1-0-493-10
FHL TEIF
SHEET NO. ____ OF 13 SHEETS

DESCRIPTION OF ACTION:

AIR COOLED CONDENSING SECTIONS FOR CHILLERS AND SPLIT SYSTEM A/C UNITS WILL BE SHADED FROM DIRECT SUNLIGHT IN ORDER TO REDUCE THE AMBIENT AIR TEMPERATURE PASSING THROUGH THE CONDENSER. THIS, IN TURN REDUCES THE HEAD PRESSURE OF THE REFRIGERANT SEEN BY THE CONDENSER AND THUS SAVES INPUT CONDENSER KILOWATT ENERGY.

FACILITIES INCLUDED:

6	177	229
141A	178	230
46/47	182	240
51A	186	287
54	206	290
80	207	291
81	208	295
131	209	301
149	210	
161	212	
162		

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY: RJB
CHECKED BY: BHH
DATE: FEB 1983
REV. ______ 19__

ECO # B-2
SHADE CONDENSERS FROM SUN
ENERGY SAVINGS CALCULATIONS

PROJECT: 16-403-10
FML FRAY
SHEET NO. 2 OF 13 SHEETS

DAILY SOLAR ENERGY: 1607 BTU/FT² DAY *

ASSUME 12 HR SOLAR HEATING DAY

$1607 \ BTU/FT^2 DAY \ / \ 12 \ HR/DAY = 134 \ BTUH/FT^2$

USE $Q = UA\Delta T$

WHERE $U = 1.64 \ BTU/HR \cdot FT^2 \cdot °F$ **

$$\Delta T = \frac{Q/A}{U} = \frac{134 \ BTUH/FT^2}{1.64 \ BTU/HR \cdot FT^2 \cdot °F} = 82°F$$

THUS 82°F IS THE COOLING LOAD TEMPERATURE DIFFERENCE

SUBTRACTING FOR CONVECTIVE LOSSES:

USE $Q = AH\Delta T$

WHERE $H = KC(N_{GR} N_{PR})^n$

C = CONSTANT (GEOMETRIC)
K = BODY THERMAL CONDUCTIVITY
N_{GR} = GRASSOF #
N_{PR} = PRANDTL #

$$H = (0.0154 \ \frac{BTU}{HR \cdot FT \cdot °F})(0.54)(1 \times 10^6)^{0.25}$$

$$= 0.26 \ BTU/HR \ FT \ °F$$

$$\therefore Q/A = 0.26 \times 82°F = 21.3 \ BTUH/FT^2$$

$$\text{AND EFFECTIVE CLTD} = \frac{134 - 21.3}{1.64} = 69°F$$

* SANTA MARIA WEATHER DATA FROM:

PASSIVE SOLAR HEATING DESIGN — J.D. BALCOMB

** ASHRAE FUND CHAPT. 23.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BH
DATE FEB 1993
REV. 19__

ECO # B-2
SHADE CONDENSERS FROM SUN
ENERGY SAVINGS CALC.

PROJECT 6-403-10
FT. BEAP

SHEET NO. 3 OF 13 SHEETS

• ASSUME AN AVERAGE AMBIENT TEMPERATURE OF 85° F. THUS WITH A 69° F CLTD THE SURFACE OF THE UNIT IS RAISED TO A TEMPERATURE OF 95 + 69 = 164° F

• ASSUME AN AVERAGE OF 5 CFM / FT² OF SURFACE AREA OF AIR IS HEATED TO 164°.

$$\frac{134 \text{ BTUH}/\text{FT}^2}{5 \text{ CFM}/\text{FT}^2} = 26.8 \text{ BTUH}/\text{CFM}$$

USE BTUH = CFM × 4.45 × Δh

$$\Delta h = \frac{\text{BTUH}/\text{CFM}}{4.45} = \frac{26.8}{4.45} = 6 \text{ BTU}/\text{lb}$$

FROM PSYCHROMETRIC CHART THE ENTERING AIR TEMPERATURE IS RAISED FROM 85° F TO 95° F

FROM MANUFACTURERS CATALOG DATA FOR AIR COOLED CHILLERS AND AIR COOLED REFRIGERANT CONDENSERS THE AVERAGE EFFICIENCY IS INCREASED BY 10% WITH A DECREASE IN ENTERING AIR TEMPERATURE FROM 95° F TO 85° F.

FORM 101-1/8

TRANE®

PSYCHROMETRIC CHART

Barometric Pressure 29.921 Inches of Mercury

1 = AVERAGE
2 - DESIGN CONDITIONS
3 - TEMPERATURE OF AMBIENT AIR DUE TO SOLAR GAIN

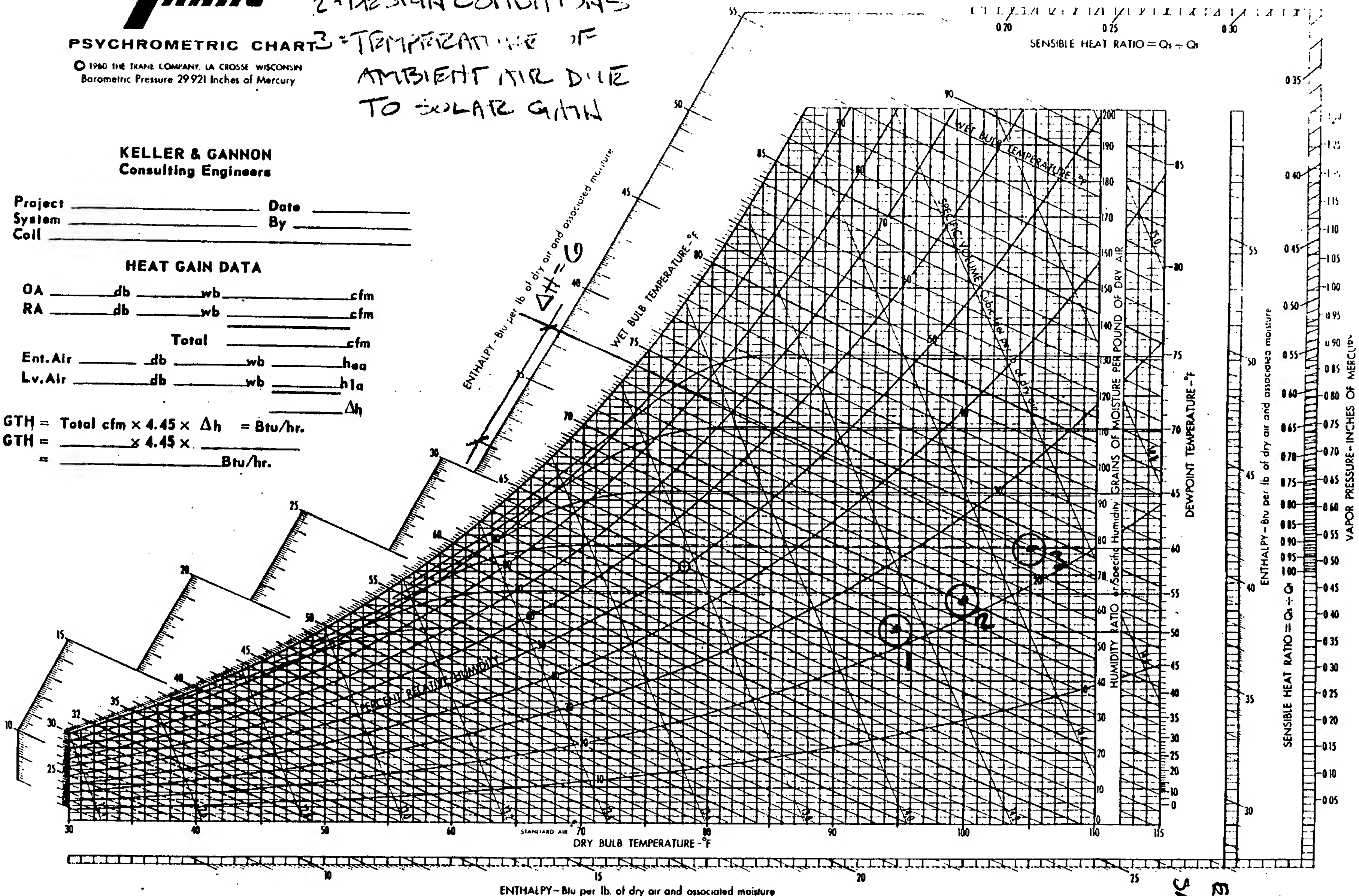
KELLER & GANNON
Consulting Engineers

Project ______________ Date ______
System ______________ By ______
Coil ______________

HEAT GAIN DATA

OA ______ db ______ wb ______ cfm
RA ______ db ______ wb ______ cfm
Total ______ cfm
Ent. Air ______ db ______ wb ______ hea
Lv. Air ______ db ______ wb ______ h1a
______ Δh

GTH = Total cfm × 4.45 × Δh = Btu/hr.
GTH = ______ × 4.45 × ______
= ______ Btu/hr.



ECO B2
Sheet 4 of 13

ECO B2
Sheet 5 of 13

Performance Data

Table 16-1 — CGACD18E (180/200-Ton Evap) Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(DEG F)	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER
40	169.6	148.0	11.8	160.3	157.4	10.6	150.4	166.2	9.5	140.0	174.6	8.4	129.0	182.6	7.5
42	175.2	150.2	12.0	165.6	160.0	10.8	155.5	169.2	9.6	144.8	177.8	8.6	133.5	186.4	7.6
44	180.9	152.6	12.3	171.0	162.4	11.0	160.6	172.0	9.8	149.6	181.2	8.7	138.0	190.2	7.7
45	183.8	153.6	12.4	173.8	163.8	11.1	163.2	173.4	9.9	152.0	183.0	8.8	140.3	192.2	7.8
46	186.7	154.8	12.5	176.5	165.0	11.2	165.8	174.8	10.0	154.5	184.6	8.9	142.6	194.1	7.8
48	192.5	157.0	12.7	182.0	167.4	11.4	171.0	177.8	10.1	159.4	188.0	9.0	147.3	198.4	7.9
50	198.3	159.2	13.0	187.6	170.0	11.6	176.3	180.8	10.3	164.4	191.6	9.1	152.0	202.6	8.0

Table 16-2 — CGACD20E (150-Ton Evap) Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(DEG F)	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER
40	180.0	166.8	11.3	170.4	176.6	10.2	160.1	186.0	9.1	149.2	194.6	8.2	137.7	203.0	7.3
42	185.8	169.4	11.5	175.8	178.6	10.3	165.3	189.2	9.3	154.1	198.4	8.3	142.3	207.2	7.4
44	191.6	172.0	11.7	181.4	182.6	10.5	170.5	192.6	9.4	159.1	202.2	8.4	146.9	211.6	7.5
45	194.5	173.4	11.8	184.2	184.0	10.6	173.2	194.2	9.5	161.6	204.0	8.5	149.3	213.8	7.5
46	197.4	174.6	11.9	187.0	185.4	10.7	175.8	195.8	9.6	164.1	206.0	8.6	151.6	216.2	7.6
48	203.3	177.2	12.1	192.6	188.4	10.9	181.2	199.2	9.7	169.1	209.8	8.7	156.4	220.8	7.7
50	209.3	179.8	12.3	198.2	191.4	11.2	186.5	202.6	9.9	174.2	213.8	8.8	161.2	225.4	7.8

Table 16-3 — CGACD20E (180/200-Ton Evap) Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(DEG F)	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER
40	188.1	170.4	11.6	177.7	180.6	10.4	166.6	190.0	9.3	154.9	199.0	8.3	142.6	207.8	7.4
42	194.2	173.2	11.8	183.4	183.6	10.6	172.1	193.7	9.5	160.0	203.0	8.4	147.4	212.0	7.5
44	200.4	176.0	12.0	189.3	186.6	10.8	177.6	197.0	9.6	165.2	206.8	8.6	152.3	216.8	7.6
45	203.5	177.4	12.1	192.2	188.2	10.8	180.4	198.6	9.7	167.9	209.0	8.6	154.7	219.2	7.6
46	206.6	178.6	12.2	195.2	189.8	10.9	183.1	200.4	9.8	170.5	211.0	8.7	157.2	221.6	7.7
48	212.8	181.4	12.4	201.1	192.8	11.1	188.8	204.0	9.9	175.8	215.2	8.8	162.2	226.4	7.8
50	219.1	184.2	12.6	207.1	195.8	11.3	194.4	207.6	10.1	181.2	219.4	8.9	167.3	231.6	7.8

Notes:
1. Ratings based on sea level altitude and evaporator fouling factor of 0.0005 per ARI 590-81 or 0.00025 per ARI 590-86.
2. Interpolation between points is permissible.
3. Extrapolation beyond points is not permissible.
4. KW input is for compressors only.
5. EER = Energy Efficiency Ratio, (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Rated in accordance with ARI Standard 590.
7. Ratings are based on an evaporator temperature drop of 10 degrees F.

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Sheet 6 of 13

Performance Data

Table 19-1 — CGAD-C40

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	36.7	31.6	12.3	34.9	35.0	10.7	33.0	39.0	9.2	31.0	43.4	7.8	28.9	48.2	6.6
42	37.9	32.0	12.6	36.0	35.4	11.0	34.1	39.4	9.4	32.0	43.8	8.1	29.9	48.6	6.8
44	39.1	32.2	12.9	37.2	35.8	11.2	35.2	39.6	9.7	33.1	44.0	8.3	31.0	49.0	7.0
45	39.7	32.4	13.1	37.8	35.8	11.4	35.8	39.8	9.8	33.7	44.2	8.4	31.5	49.2	7.1
46	40.4	32.6	13.2	38.4	36.0	11.5	36.4	40.0	9.9	34.3	44.4	8.5	32.0	49.4	7.2
48	41.6	32.8	13.5	39.6	36.4	11.8	37.5	40.4	10.1	35.4	44.8	8.7	33.1	49.8	7.4
50	42.9	33.2	13.8	40.9	36.8	12.0	38.7	40.8	10.4	36.5	45.2	8.9	34.2	50.4	7.6
55	46.2	34.0	14.6	44.0	37.6	12.7	41.8	41.8	11.0	39.5	46.4	9.4	37.1	51.4	8.0
60	49.6	34.8	15.3	47.3	38.4	13.3	45.0	42.6	11.5	42.5	47.4	9.9			

Notes:
1. Ratings based on a 0.0005 fouling factor at sea level per ARI standard 590-81 or 0.00025 fouling factor at sea level per ARI standard 590-86.
2. Interpolation between points is permissible.
3. Extrapolation beyond points is not permissible.
4. Kw input is for compressors only.
5. EER = Energy Efficiency Ratio. (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Rated in accordance with ARI standard 590.
7. Ratings are based on an evaporator temperature drop of 10 F.

Table 19-2 — CGAD-C50

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	46.0	41.6	11.6	43.8	45.8	10.2	41.6	50.6	8.8	39.2	56.0	7.6	36.6	62.2	6.5
42	47.5	42.0	11.9	45.3	46.2	10.4	43.0	51.2	9.0	40.5	56.6	7.8	37.9	62.6	6.6
44	49.1	42.4	12.2	46.8	46.8	10.7	44.4	51.6	9.3	41.8	57.0	8.0	39.2	63.2	6.8
45	49.8	42.6	12.3	47.5	47.0	10.8	45.1	51.8	9.4	42.5	57.4	8.1	39.9	63.4	6.9
46	50.6	42.8	12.5	48.3	47.2	10.9	45.8	52.2	9.5	43.2	57.6	8.2	40.5	63.8	7.0
48	52.2	43.4	12.7	49.8	47.6	11.2	47.3	52.6	9.7	44.6	58.2	8.4	41.9	64.2	7.2
50	53.8	43.8	13.0	51.3	48.2	11.4	48.8	53.2	9.9	46.1	58.6	8.6	43.2	64.8	7.3
55	57.9	45.0	13.7	55.3	49.4	12.0	52.6	54.4	10.5	49.7	60.0	9.1	46.8	66.2	7.8
60	62.1	46.2	14.3	59.4	50.6	12.6	56.5	55.8	11.0	53.6	61.4	9.5			

Notes:
1. Ratings based on a 0.0005 fouling factor at sea level per ARI standard 590-81 or 0.00025 fouling factor at sea level per ARI standard 590-86.
2. Interpolation between points is permissible.
3. Extrapolation beyond points is not permissible.
4. Kw input is for compressors only.
5. EER = Energy Efficiency Ratio. (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Rated in accordance with ARI standard 590.
7. Ratings are based on an evaporator temperature drop of 10 F.

Table 19-3 — CGD-C60

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	54.5	48.6	12.0	52.0	53.8	10.5	49.4	59.6	9.0	46.6	66.0	7.8	43.7	73.2	6.6
42	56.3	49.2	12.3	53.7	54.4	10.7	51.1	60.2	9.3	48.2	66.8	8.0	45.2	73.8	6.8
44	58.1	49.6	12.6	55.5	55.0	11.0	52.7	60.8	9.5	49.8	67.4	8.2	46.7	74.4	7.0
45	59.0	49.8	12.7	56.4	55.2	11.1	53.6	61.2	9.6	50.6	67.6	8.3	47.5	74.8	7.1
46	59.9	50.2	12.8	57.3	55.4	11.2	54.4	61.4	9.7	51.4	68.0	8.4	48.3	75.2	7.2
48	61.8	50.6	13.1	59.1	56.0	11.4	56.2	62.0	9.9	53.1	68.6	8.6	49.9	75.8	7.3
50	63.7	51.2	13.4	60.9	56.6	11.7	57.9	62.6	10.1	54.8	69.2	8.8	51.5	76.4	7.5
55	68.6	52.6	14.1	65.6	58.0	12.3	62.4	64.2	10.7	59.1	70.8	9.2	55.7	78.2	7.9
60	73.6	53.8	14.8	70.4	59.6	12.9	67.1	65.8	11.2	63.6	72.6	9.7			

Notes:
1. Ratings based on a 0.0005 fouling factor at sea level per ARI standard 590-81 or 0.00025 fouling factor at sea level per ARI standard 590-86.
2. Interpolation between points is permissible.
3. Extrapolation beyond points is not permissible.
4. Kw input is for compressors only.
5. EER = Energy Efficiency Ratio. (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Rated in accordance with ARI standard 590.
7. Ratings are based on an evaporator temperature drop of 10 F.

ECO B2
Sheet 7 of 13

TABLE 16-1 — System Capacity Data — Air-Cooled Condenser with Compressor Chiller (cont.)

AIR-COOLED CONDENSER COMPRESSOR CHILLER COMBINATION	LEAVING CHILLED WATER TEMPERATURE (F)	OUTSIDE AMBIENT TEMPERATURE ENTERING CONDENSER (F)					
		85		95		105	
		TONS	KW	TONS	KW	TONS	KW
CAUA 800 WITH CCUA 080 R	40	73 2	74 9	66.6	79.1	62.3	83.0
	42	74 1	76.1	69.1	80.4	64.5	84 4
	45	77 5	77.9	72.9	82.2	67.9	86.5
	48	81.4	79.4	76.5	84.0	71.4	88.7
	50	83.7	80.8	78.9	85.6	74 0	90.5
(2) CAUA 800 WITH CCUA 120 R	40	119.4	103.1	110.4	110.7	99.4	117.4
	42	118.1	104.5	110.6	112.3	102.9	119.4
	45	123.8	106.6	116.0	114.8	108.0	122.3
	48	129.3	108.7	121.4	117.1	113.2	125.0
	50	133.1	110.0	125.2	118.6	116.8	126.8
(2) CAUA 800 WITH CCUA 150 E	40	134.6	129.3	124.7	137.3	115.7	145.6
	42	139.0	131.6	129.0	140.0	120.0	148.0
	45	145.6	134.2	135.4	144.0	126.4	151.6
	48	153.0	139.8	142.2	147.6	132.8	156.0
	50	157.5	140.6	147.0	149.9	137.2	154.3
(1) CAUA 800 AND (1) CAUA 1000 WITH CCUA 180 E	40	156.0	150.8	141.5	160.0	133.8	168.5
	42	161.3	153.3	150.1	162.8	138.7	171.6
	45	169.3	157.1	157.6	167.0	146.1	176.3
	48	178.0	161.0	165.5	171.3	153.7	181.5
	50	183.4	163.3	170.8	172.8	158.6	184.1
CAUA 1000 WITH CCUA 075 E	40	69.3	61.7	64.3	66.5	59.3	70.3
	42	71.6	62.8	66.6	67.5	61.6	71.6
	45	75.1	64.5	70.1	69.0	65.1	73.5
	48	77.8	65.3	73.7	70.3	68.4	75.0
	50	81.1	66.4	76.2	71.4	70.8	76.2
CAUA 1000 WITH CCUA 080 R	40	74.0	72.1	69.3	76.9	64.2	80.8
	42	76.3	73.2	71.6	77.8	66.7	82.0
	45	79.7	75.0	75.1	79.2	70.5	83.7
	48	82.2	76.7	79.1	80.8	74.2	85.6
	50	86.1	77.9	81.4	82.2	76.8	87.3
CAUA 1000 WITH CCUA 100 E	40	88.7	85.9	82.7	91.3	76.2	95.7
	42	91.8	87.5	85.6	92.8	78.9	96.6
	45	96.5	90.0	89.9	95.0	82.9	100.5
	48	101.5	92.0	94.4	97.5	87.3	103.2
	50	104.6	93.3	97.3	99.2	90.0	105.1
CAUA 1000 WITH CCUA 100 R	40	89.9	89.1	83.9	94.2	77.8	98.7
	42	92.9	90.5	86.8	95.6	80.6	100.2
	45	97.6	92.3	91.3	97.8	84.8	102.8
	48	102.3	94.3	95.9	99.9	89.3	105.5
	50	105.5	95.5	99.0	101.3	92.4	106.8
(2) CAUA 1000 WITH CCUA 150 E	40	138.7	123.3	128.5	132.0	118.7	140.7
	42	143.2	125.6	133.2	135.0	123.2	143.8
	45	150.2	129.0	140.2	138.0	130.2	147.0
	48	155.6	130.6	147.4	140.6	136.8	150.0
	50	162.3	132.9	152.3	142.9	141.6	152.4

NOTES:
(1) Kw is for compressor only.
(2) Capacities are at a 10 F Δt.

TABLE 16-1 — System Capacity Data — Air-Cooled Condenser with Compressor Chiller (cont.)

AIR-COOLED CONDENSER COMPRESSOR CHILLER COMBINATION	LEAVING CHILLED WATER TEMPERATURE (F)	OUTSIDE AMBIENT TEMPERATURE ENTERING CONDENSER (F)					
		85		95		105	
		TONS	KW	TONS	KW	TONS	KW
(1) CAUA 1000 AND (1) CAUA 1200 WITH CCUA 180 E	40	159.0	145.2	145 5	155.5	133 9	165 5
	42	165 1	147 8	153 7	158.2	141 6	167 0
	45	174 3	151 7	166 0	162.3	153.1	172.3
	48	181 3	154.0	170 4	165 3	156 6	176 4
	50	187.7	156 5	175.7	167 4	162.2	178 5
(2) CAUA 1000 WITH CCUA 200 E	40	177.3	171 7	165.5	182.7	152.5	191 3
	42	183.6	175 0	171 2	185 6	157 8	196.6
	45	196.0	180 6	179.8	170 0	165 8	201 0
	48	205.9	184 0	188 4	193 0	175 6	206 4
	50	209.3	186.7	194 7	198.3	180 4	210 1
CAUA 1200 WITH CCUA 100 E	40	89 7	83.5	83.5	89 0	77 0	94 1
	42	93.5	85 0	87 1	90.7	80 0	96 0
	45	99 2	87 2	92 5	93.3	84 5	98 8
	48	103.5	88 7	96 5	95 0	88.2	101 0
	50	106.6	90.0	99 5	96 0	91 4	102.3
CAUA 1200 WITH CCUA 100 R	40	92.7	86 8	86 4	92.2	80.2	97 1
	42	95.8	88.0	89.6	93.6	83.2	98.6
	45	100.7	89.8	94 1	95.6	87 7	100.9
	48	105.9	91 5	99 1	97 5	92.3	103 1
	50	109 1	92.5	102.4	98.8	95.4	104 5
CAUA 1200 WITH CCUA 120 R	40	111 0	108.0	103.8	114 8	96.5	121 3
	42	114.4	109.7	107 1	116.8	99.7	123.4
	45	119.6	112.3	112.2	119.7	104.5	126 7
	48	125.0	114.8	117.3	122.6	109.3	129.8
	50	128.6	116.4	120 6	124 4	112 7	131 8
(2) CAUA 1200 WITH CCUA 200 E	40	179.4	165.6	157.0	177.9	154.0	188.3
	42	187.0	170 0	174 2	181 4	160 0	192.0
	45	198 4	174 4	185 0	186.6	168.0	197 6
	48	212.4	188.0	197 6	200.0	182 8	202.0
	50	213 1	180.1	199.0	192.0	182.8	204.7

NOTES:
(1) Kw is for compressor only.
(2) Capacities are at a 10 F Δt.

ECO B2
Sheet 8 of 13

ECO-2 Energy Savings

Building	Cooling System Energy After Previous ECO's (kWH/Yr	Savings @10%	Energy Svg $/Y	Building	Cooling System Energy After Previous ECO's (kWH/	Savings @10%	Energy Svg $/Yr
6	5,818	512	$38	186	5,480	482	$36
41A	10,925	961	$72	206	49,146	4,325	$323
46	7,726	680	$51	207	75,188	6,617	$494
47	7,726	680	$51	208	79,324	6,981	$521
51A	12,694	1,117	$83	209	36,698	3,229	$241
54	7,726	680	$51	210	25,095	2,208	$165
80	4,890	430	$32	212	12,278	1,080	$81
81	9,488	835	$62	229	79,326	6,981	$521
131	5,265	463	$35	230	79,326	6,981	$521
149	6,656	586	$44	240	8,936	786	$59
161	3,872	341	$25	287	18,628	1,639	$122
162	3,872	341	$25	290	11,806	1,039	$77
177	10,869	956	$71	291	7,313	644	$48
178	12,405	1,092	$81	295	150,203	13,218	$986
182	3,120	275	$20	301	22,620	1,991	$148

ECO B2
Sheet 9 of 13

ECO-2 Energy Savings

Building	Construction Cost	Units	No.	Labor	Total	Material	Total	Total cost
6	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
41a	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
46	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
47	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
51a	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
54	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
80	Wood Screeen	sf	200	$1	$268	$6	$1,176	$1,444
	Wood Column	LF	40	$7	$277	$6	$252	$529
	TOTAL							$1,973
81	Wood Screeen	sf	400	$1	$536	$6	$2,352	$2,888
	Wood Column	LF	80	$7	$554	$6	$503	$1,058
	TOTAL							$3,946
131	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
149	Wood Screeen	sf	150	$1	$201	$6	$882	$1,083
	Wood Column	LF	50	$7	$347	$6	$315	$661
	TOTAL							$1,744
161	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
162	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
177	Wood Screeen	sf	250	$1	$335	$6	$1,470	$1,805

ECO B2
Sheet 10 of 13

ECO-2 Energy Savings

	Wood Column	LF	30	$7	$208	$6	$189	$397
	TOTAL							$2,202
178	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
182	Wood Screeen	sf	800	$1	$1,072	$6	$4,704	$5,776
	Wood Column	LF	60	$7	$416	$6	$377	$793
	TOTAL							$6,569
186	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
206	Wood Screeen	sf	250	$1	$335	$6	$1,470	$1,805
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$2,069
207	Wood Screeen	sf	1000	$1	$1,340	$6	$5,880	$7,220
	Wood Column	LF	100	$7	$693	$6	$629	$1,322
	TOTAL							$8,542
208	Wood Screeen	sf	1000	$1	$1,340	$6	$5,880	$7,220
	Wood Column	LF	100	$7	$693	$6	$629	$1,322
	TOTAL							$8,542
209	Wood Screeen	sf	400	$1	$536	$6	$2,352	$2,888
	Wood Column	LF	30	$7	$208	$6	$189	$397
	TOTAL							$3,285
210	Wood Screeen	sf	500	$1	$670	$6	$2,940	$3,610
	Wood Column	LF	40	$7	$277	$6	$252	$529
	TOTAL							$4,139
212	Wood Screeen	sf	200	$1	$268	$6	$1,176	$1,444
	Wood Column	LF	30	$7	$208	$6	$189	$397
	TOTAL							$1,841
229	Wood Screeen	sf	1000	$1	$1,340	$6	$5,880	$7,220
	Wood Column	LF	100	$7	$693	$6	$629	$1,322
	TOTAL							$8,542
230	Wood Screeen	sf	1000	$1	$1,340	$6	$5,880	$7,220
	Wood Column	LF	100	$7	$693	$6	$629	$1,322
	TOTAL							$8,542
240	Wood Screeen	sf	600	$1	$804	$6	$3,528	$4,332
	Wood Column	LF	50	$7	$347	$6	$315	$661
	TOTAL							$4,993

ECO B2
Sheet 11 of 13

ECO-2 Energy Savings

287	Wood Screeen	sf	200	$1	$268	$6	$1,176	$1,444
	Wood Column	LF	30	$7	$208	$6	$189	$397
	TOTAL							$1,841
290	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
291	Wood Screeen	sf	100	$1	$134	$6	$588	$722
	Wood Column	LF	20	$7	$139	$6	$126	$264
	TOTAL							$986
295	Wood Screeen	sf	1000	$1	$1,340	$6	$5,880	$7,220
	Wood Column	LF	100	$7	$693	$6	$629	$1,322
	TOTAL							$8,542
301	Wood Screeen	sf	2000	$1	$2,680	$6	$11,760	$14,440
	Wood Column	LF	250	$7	$1,733	$6	$1,573	$3,305
	TOTAL							$17,745

ECO B2
Sheet 12 of 13

Building	Bare Cost	Construction Total	Investment Total	O&M/YR Saved	O&M LCC $	Energy Svg/Yr	Energy LCC $	Savings Total $/Yr	Savings LCC $	Payback Years	SIR
6	$986	$1,539	$1,716	($25)	($274)	$38	$447	$14	$173	126.8	0.101
41A	$986	$1,539	$1,716	($25)	($274)	$72	$839	$47	$565	36.5	0.329
46	$986	$1,539	$1,716	($25)	($274)	$51	$593	$26	$319	65.9	0.186
47	$986	$1,539	$1,716	($25)	($274)	$51	$593	$26	$319	65.9	0.186
51A	$986	$1,539	$1,716	($25)	($274)	$83	$975	$59	$701	29.2	0.408
54	$986	$1,539	$1,716	($25)	($274)	$51	$593	$26	$319	65.9	0.186
80	$1,973	$3,077	$3,431	($49)	($548)	$32	$376	($17)	($173)	(199.2)	(0.050)
81	$3,946	$6,155	$6,862	($99)	($1,097)	$62	$729	($36)	($368)	(188.7)	(0.054)
131	$986	$1,539	$1,716	($25)	($274)	$35	$404	$10	$130	173.3	0.076
149	$1,744	$2,720	$3,033	($44)	($485)	$44	$511	$0	$26	35169	0.009
161	$986	$1,539	$1,716	($25)	($274)	$25	$297	$1	$23	2271	0.013
162	$986	$1,539	$1,716	($25)	($274)	$25	$297	$1	$23	2271	0.013
177	$2,202	$3,434	$3,829	($55)	($612)	$71	$835	$16	$223	234.9	0.058
178	$986	$1,539	$1,716	($25)	($274)	$81	$953	$57	$678	30.2	0.395
182	$6,569	$10,247	$11,425	($164)	($1,826)	$20	$240	($144)	($1,587)	(79.5)	(0.139)
186	$986	$1,539	$1,716	($25)	($274)	$36	$421	$11	$147	151.7	0.085
206	$2,069	$3,228	$3,599	($52)	($575)	$323	$3,774	$271	$3,199	13.3	0.889
207	$8,542	$13,324	$14,856	($214)	($2,375)	$494	$5,774	$280	$3,400	53.1	0.229
208	$8,542	$13,324	$14,856	($214)	($2,375)	$521	$6,092	$307	$3,717	48.4	0.250
209	$3,285	$5,123	$5,713	($82)	($913)	$241	$2,818	$159	$1,905	36.0	0.334
210	$4,139	$6,456	$7,198	($103)	($1,151)	$165	$1,927	$61	$777	117.5	0.108
212	$1,841	$2,871	$3,201	($46)	($512)	$81	$943	$35	$431	92.6	0.135
229	$8,542	$13,324	$14,856	($214)	($2,375)	$521	$6,092	$307	$3,717	48.4	0.250
230	$8,542	$13,324	$14,856	($214)	($2,375)	$521	$6,092	$307	$3,717	48.4	0.250
240	$4,993	$7,788	$8,684	($125)	($1,388)	$59	$686	($66)	($702)	(131.2)	(0.081)
287	$1,841	$2,871	$3,201	($46)	($512)	$122	$1,431	$76	$919	42.0	0.287
290	$986	$1,539	$1,716	($25)	($274)	$77	$907	$53	$632	32.5	0.369
291	$986	$1,539	$1,716	($25)	($274)	$48	$562	$23	$287	73.5	0.168
295	$8,542	$13,324	$14,856	($214)	($2,375)	$986	$11,535	$772	$9,161	19.2	0.617
301	$17,745	$27,679	$30,863	($444)	($4,933)	$148	$1,737	($295)	($3,196)	(104.6)	(0.104)
Total	$107,876	$168,273	$187,625	********	*********	$5,083	$59,474	$2,386	$29,483	78.6	0.157

($2697) ($29,990)

Construction Cost....Installed Cost
O&M/YR..................Yearly maintenance scheduled as 2.5% of installed cost
Sales Tax..................6% of total
OH & P......................Contractors overhead and profit 30%
Bond..........................1%
Contingency............Estimators contingency 10%
Savings....................Yearly savings multiplied by UPW factor for 15 years (11.12)
SIR.............................Savings/(Cost+Maint*UPW)

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B2
Sheet 13 fo 13

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: Install Shades over HVAC Condensers — Fiscal Year FY96
Discrete Portion Name: ECO# B-2
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$168,273		
B. SIOH	$9,255		
C. Design Cost	$10,096		
D. Total Cost (1A+1B+1C)	$187,624		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$187,624

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	279	$5,083	11.70	$59,471
B. Dist	$4.98	0	$0	13.78	$0
C. Propane	$7.87	0	$0	14.16	$0
D. Other					
E. Demand Savings					
F. Total			$5,083		$59,471

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($2,697)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($29,991)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) ($29,991)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	78.6	Years
5. Total Net Discounted Savings (2F5+3C):	$29,480	
6. Savings to Investment Ratio (SIR) 5/1G:	0.16	
7. Adjusted Internal Rate of Return (AIRR):	-9.60%	

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY BJH
CHECKED BY
DATE MARCH 19 93
REV. JUNE 19 93

ECO B3
INSULATE DUCTWORK

PROJECT 16-403-10
FHL-EEAP
SHEET NO. 1 OF 6 SHEETS

DESCRIPTION OF ACTION

Insulate ductwork exposed to the ambient. Existing ductwork is either not insulated, or has deteriorated insulation, making it ineffective.

BUILDINGS INCLUDED.

127 INSULATE FURNACE CASING ABOVE FIREBOX
146 INSULATE 30SF OF SA DUCT OUTSIDE HTG ONLY 50-16d

ENERGY SAVING CALCULATIONS

BLDG 127 FURNACE CASING AREA: ~45 SF
TEMP OF CASING ~ 140°F IN MECH RM

BLDG 146 30SF DUCT - HEATING ONLY 120°F OUTSIDE

BLDG	ΔT		"BARE" USE ½" FOR PAINT, ETC	2" INSUL
127	(~~140~~ 200 - 50) =	~~90~~ 150 °F @ BLOCK ⇒	~~32~~ 64 BTU/HR/SF	10 BTUH/SF
146	(120 - 24) =	94 °F @ BLOCK ⇒	32 BTUH/SF	10 BTUH/SF

USE ΔT = 70°F FOR ~~BOTH~~ 146 double for 127
FOR CONSERVATIVE ESTIMATE

BTUH/SF SAVINGS: 22 BTUH/SF

BLDG 127: 45 SF × ~~22~~ 54 = ~~990~~ 2430 BTUH × 1364 Full Load Hrs = ~~1.35~~ 3.31 Mil BTU/Y

BLDG 146: 30SF × 22 = 330 BTUH × 281 Full Load Hrs = 0.092 Mil BTU

DIVIDING BY WAF η's =

BLDG 127 = ~~1.35~~ 3.31/0.64 = ~~2.11~~ 5.17 Mil BTU/Yr Propane

BLDG 146 = 0.092/0.62 = 0.15 Mil BTU/Y Propane

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H CHECKED BY DATE MARCH 1992 REV. JUNE 1993	ECO B3 INSULATE DUCTWORK	PROJECT 16-403-10 FHL-EEAP SHEET NO. 2 OF 6 SHEETS

	BLDG 127	BLDG 146
PROPANE SAVED	~~3.1~~ 5.17 Mil Btu/Yr	0.15 Mil Btu/Yr
COST SAVED @$ 7.87/Mil Btu	$ ~~16.61~~ 40.68 /YR	$ 1.18 /YR
LCC SAVED, N = 15 YR, UPW = 14.16	$ ~~235~~ 576.02	$ 16.67

NO Additional O&M costs assumed

Refer to cost estimates and LCC Analyses on following sheets.

AIR LEAKAGE CONSIDERATIONS

Leakage from HVAC ductwork can account for losses of about 10% or higher. Insulating ductwork, including retaping of ductwork joints can reduce such losses by as much as 50%.

The two buildings evaluated for this ECO do not qualify for such savings (due to insulation installation alone) as the ductwork in building 146 is only exposed outside (30 SF) and the SA ductwork runs inside the conditioned space of this shop building. The insulation retrofit for building 127 addresses only the boiler, not ductwork.

FORM 101-1/8

ECO B3
Sheet 3 of 6

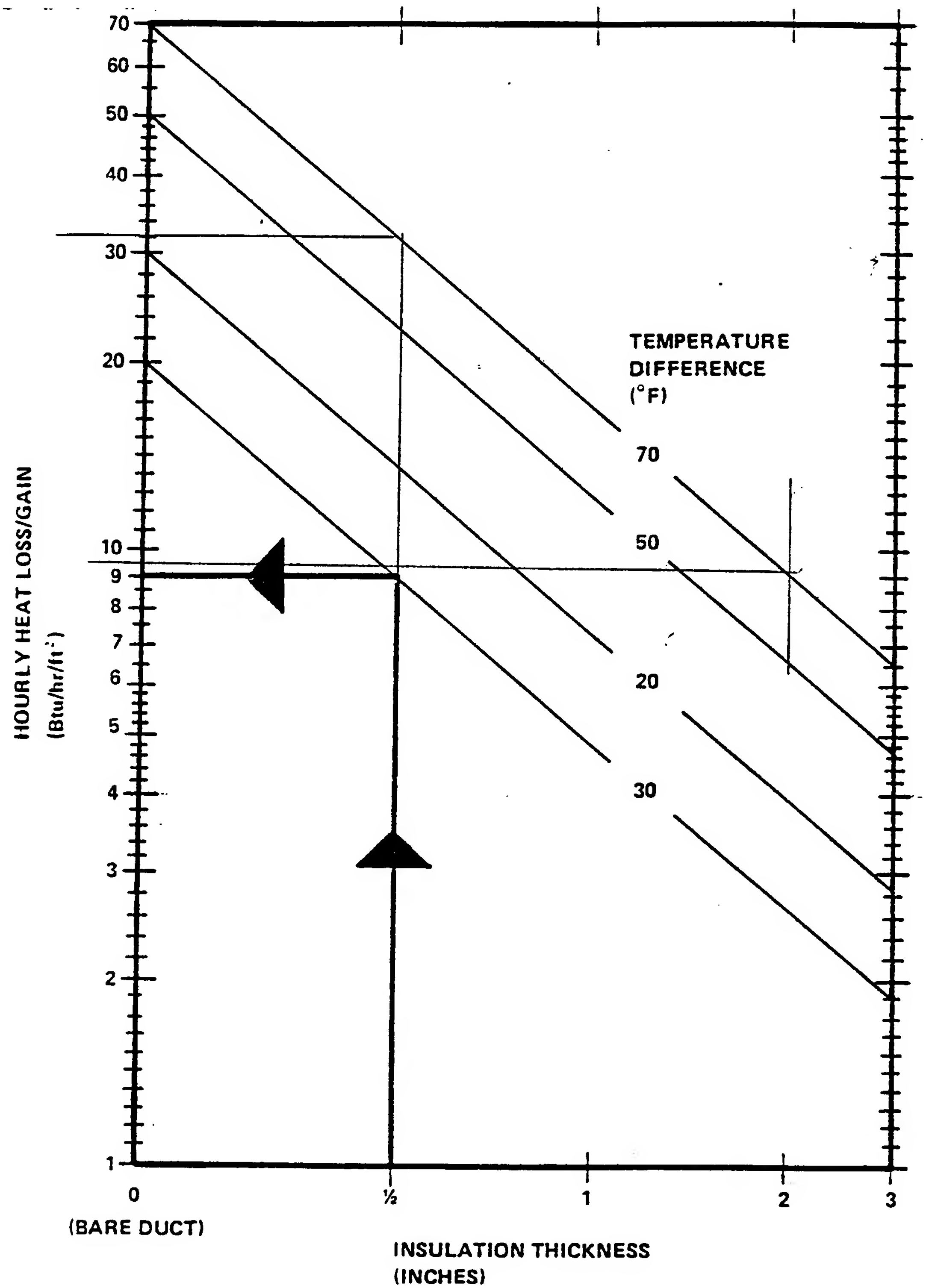


FIGURE 8-46. DUCT INSULATION-HEAT LOSS/GAIN FOR VARIOUS THICKNESS

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 4 OF 6
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-B3 Insulate Ductwork	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 127							
2-inch Thick Insulation - FG	45	SF	1.92	$87	1.20	$54	$141
Weatherproof, Non-metallic	45	SF	5.80	$261	3.48	$156	$417
Subtotal Building 127							$558
Sales Tax 8%							$45
Contractor O.H. & P 30%							$45
Sub Total							$647
Bond 1%							$6
Sub Total							$654
Estimating Contingency 10%							$65
Total Probable Construction Cost							$719
Building 146							
2-inch Thick Insulation - FG	30	SF	1.92	$58	1.20	$36	$94
Weatherproof, Non-metallic	30	SF	5.80	$174	3.48	$104	$278
Subtotal Building 146							$372
Sales Tax 8%							$30
Contractor O.H. & P 30%							$30
Sub Total							$432
Bond 1%							$4
Sub Total							$436
Estimating Contingency 10%							$44
Total Probable Construction Cost							$479

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B3
Sheet 5 fo 6

Location: Fort Hunter Liggett, California | Region No. 4 | Project No. 16-40
Project Title: Insulate Ductwork, Building 127 | Fiscal Year FY9
Discrete Portion Name: ECO# B-3
Analysis Date: June 1993 | Economic Life: 15 YEARS | Preparer: KELLE

1. Investment Costs

A. Construction Costs	$719		
B. SIOH	$40		
C. Design Cost	$43		
D. Total Cost (1A+1B+1C)	$802		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$802

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0	$0	11.70	$0
B. Dist	$4.98	0	$0	13.78	$0
C. Propane	$7.87	5.2	$41	14.16	$576
D. Other					
E. Demand Savings					
F. Total			$41		$576

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	19.7	Years
5. Total Net Discounted Savings (2F5+3C):	$576	
6. Savings to Investment Ratio (SIR) 5/1G:	0.72	
7. Adjusted Internal Rate of Return (AIRR):	Negative	

File: F\PROJ\1640310\ENGR\ECO\LCC-B3A.WQ1

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B3
Sheet 6 fo 6

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-40
Project Title: Insulate Ductwork, Building 146 — Fiscal Year FY96
Discrete Portion Name: ECO# B-3
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER

1. Investment Costs			
A. Construction Costs	$479		
B. SIOH	$26		
C. Design Cost	$29		
D. Total Cost (1A+1B+1C)	$535		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$535

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0	$0	11.70	$0
B. Dist	$4.98	0	$0	13.78	$0
C. Propane	$7.87	0.15	$1	14.16	$17
D. Other					
E. Demand Savings					
F. Total			$1		$17

3. Non Energy Savings (+) or Cost (-):			
A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	452.9	Years
5. Total Net Discounted Savings (2F5+3C):	$17	
6. Savings to Investment Ratio (SIR) 5/1G:	0.03	
7. Adjusted Internal Rate of Return (AIRR):	Negative	

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BIH
DATE MARCH 1993
REV. JUNE 1993

ECO# B-4
INSULATE PIPE FITTINGS
PROJECT DESCRIPTION

PROJECT 16-403-10
FTL FEAP

SHEET NO. 1 OF 20 SHEETS

DESCRIPTION OF ACTION

STEAM, HOT WATER, CONDENSATE AND CHILLED WATER PIPING FOR HVAC APPLICATIONS WHICH IS NOT INSULATED WILL BE INSULATED. THIS WILL REDUCE UNWANTED HEAT TRANSFER IN AND OUT OF THE WORKING FLUIDS AND THUS INCREASE OVERALL HEATING AND COOLING EFFICIENCY

FACILITIES INCLUDED

BLDG

6	206	238
80	207	241
81	208	287
124	209	290
127	212	291
131	219	
190	229	
197	230	

FORM 101-1/8

REV. JUNE 1993

ECO B4

ECO B-4 INSULATE HW PIPING (Revised June 1993)

WITH STANDARD INSULATION

Building	Savings Electric kWHr	Propane MBTU/Yr	Oil MBTU/Yr	Cost Savings Electric $/Yr	Propane $/Yr	Oil $/Yr	Total Energy $/Yr	O&M Cost Saved $/Yr	LCC Energy $	Total LCC Saved $	Bare Cost $	Construction Cost $	Investment $	Savings to Invest Ratio
80	0.00	11.80	0.00	$0.00	$92.87	$0.00	$92.87	($8.77)	$1,315	$1,217	$225	$351	$391	3.11
81	0.00	1.20	0.00	$0.00	$9.44	$0.00	$9.44	($5.46)	$134	$73	$140	$218	$243	0.30
190	0.00	0.00	3.70	$0.00	$0.00	$18.43	$18.43	($2.63)	$254	$225	$68	$105	$117	1.91
206	0.00	0.00	22.90	$0.00	$0.00	$114.04	$114.04	($10.47)	$1,571	$1,455	$269	$419	$467	3.12
207	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.46)	$583	$523	$140	$218	$243	2.15
208	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.46)	$583	$523	$140	$218	$243	2.15
209	0.00	2.50	0.00	$0.00	$19.68	$0.00	$19.68	($1.75)	$279	$259	$45	$70	$78	3.31
219	0.00	5.20	0.00	$0.00	$40.92	$0.00	$40.92	($3.51)	$579	$540	$90	$140	$157	3.45
229	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.46)	$583	$523	$140	$218	$243	2.15
230	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.46)	$583	$523	$140	$218	$243	2.15
238	0.00	2.30	0.00	$0.00	$18.10	$0.00	$18.10	($1.75)	$256	$237	$45	$70	$78	3.03
241	15.40	5.40	0.00	$0.96	$42.50	$0.00	$43.46	($5.46)	$613	$552	$140	$218	$243	2.27
290	36.00	3.30	0.00	$2.24	$25.97	$0.00	$28.21	($8.97)	$394	$294	$230	$359	$400	0.74
291	0.00	9.50	0.00	$0.00	$74.77	$0.00	$74.77	($2.73)	$1,059	$1,028	$70	$109	$122	8.45
SIR > 1	15.40	39.10	60.60	$0.96	$307.72	$301.79	$610.46	($69.84)	$8,527	$7,750	$1,791	$2,794	$3,115	2.49

WITH REMOVABLE TYPE INSULATION

Building	Savings Electric kWHr	Propane MBTU/Yr	Oil MBTU/Yr	Cost Savings Electric $/Yr	Propane $/Yr	Oil $/Yr	Total Energy $/Yr	O&M Cost Saved $/Yr	LCC Energy $	Single Year (#10) $ Saved	Total LCC Save $	Bare Cost $	Construction Cost $	Investment $	Savings to Invest Ratio
80	0.00	11.80	0.00	$0.00	$92.87	$0.00	$92.87	($12.04)	$1,315	$225	$1,406	$386	$602	$671	2.09
81	0.00	1.20	0.00	$0.00	$9.44	$0.00	$9.44	($5.47)	$134	$102	$175	$175	$274	$305	0.57
190	0.00	0.00	3.70	$0.00	$0.00	$18.43	$18.43	($3.53)	$254	$66	$281	$113	$176	$197	1.43
206	0.00	0.00	22.90	$0.00	$0.00	$114.04	$114.04	($3.33)	$1,571	$62	$1,597	$107	$167	$186	8.60
207	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.60)	$583	$105	$626	$179	$280	$312	2.01
208	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.60)	$583	$105	$626	$179	$280	$312	2.01
209	0.00	2.50	0.00	$0.00	$19.68	$0.00	$19.68	($2.35)	$279	$44	$296	$75	$118	$131	2.26
219	0.00	5.20	0.00	$0.00	$40.92	$0.00	$40.92	($2.41)	$579	$45	$598	$77	$120	$134	4.45
229	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.60)	$583	$105	$626	$179	$280	$312	2.01
230	0.00	0.00	8.50	$0.00	$0.00	$42.33	$42.33	($5.60)	$583	$105	$626	$179	$280	$312	2.01
238	0.00	2.30	0.00	$0.00	$18.10	$0.00	$18.10	($2.41)	$256	$45	$275	$77	$120	$134	2.04
241	15.40	5.40	0.00	$0.96	$42.50	$0.00	$43.46	($5.48)	$613	$102	$654	$176	$274	$305	2.14
290	36.00	3.30	0.00	$2.24	$25.97	$0.00	$28.21	($10.18)	$394	$190	$471	$326	$509	$568	0.83
291	0.00	9.50	0.00	$0.00	$74.77	$0.00	$74.77	($2.68)	$1,059	$50	$1,079	$86	$134	$149	7.22
SIR > 1	15.40	39.10	60.60	$0.96	$307.72	$301.79	$610.46	($67.56)	$8,527	$1,262	$9,038	$2,166	$3,378	$3,766	2.40

Energy Savings from attached hand calculations — O&M UPW = 11.12

Electricity	$0.0622	per kWHr, UPW =	11.70
Propane	$7.87	per MBTU, UPW =	14.16
Fuel Oil	$4.98	per MBTU, UPW =	13.78

O&M: Without "Zip" type 2.5% Constr Cost, With "Zip" type, 2%; also assume saved replacement cost at yr 10 at 1/2 Investment for removal & repair with removable type insulation.

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BH
DATE MARCH 1993
REV. JUNE 1993

ECO# B-4
INSULATE PIPE & FITTINGS
HEAT LOSS/GAIN CALCULATIONS

PROJECT 16-403-10
FHL EEAP

SHEET NO. 3 OF 20 SHEETS

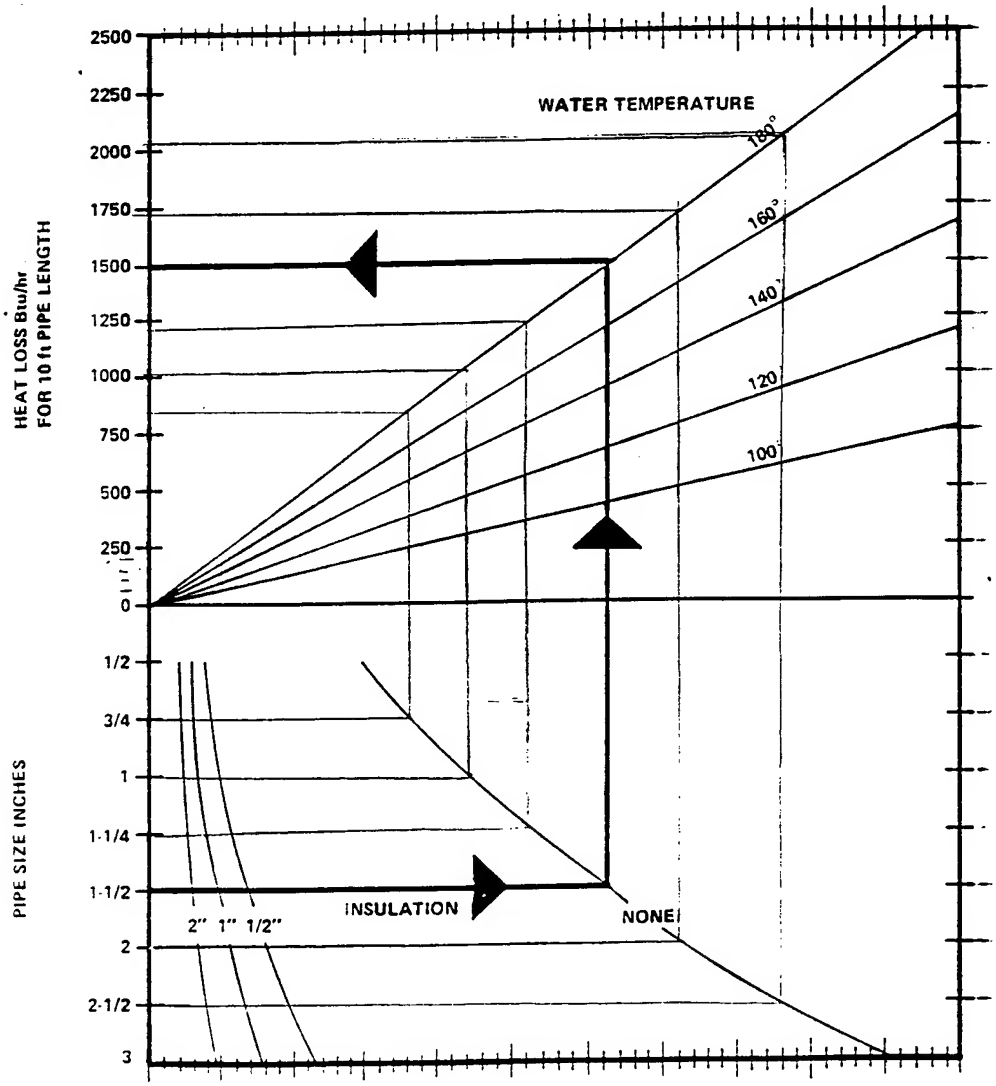
ASSUMPTIONS

HOT WATER HEATING

190° SUPPLY / 170° RETURN ⇒ 180° AVE

USE DOE "ENERGY CONSERVATION IN EXISTING BUILDINGS PG. 8-47"

INSULATE BARE PIPES W 1" INSULATION



FORM 101-1/8

Keller & Gannon
Engineers-Architects

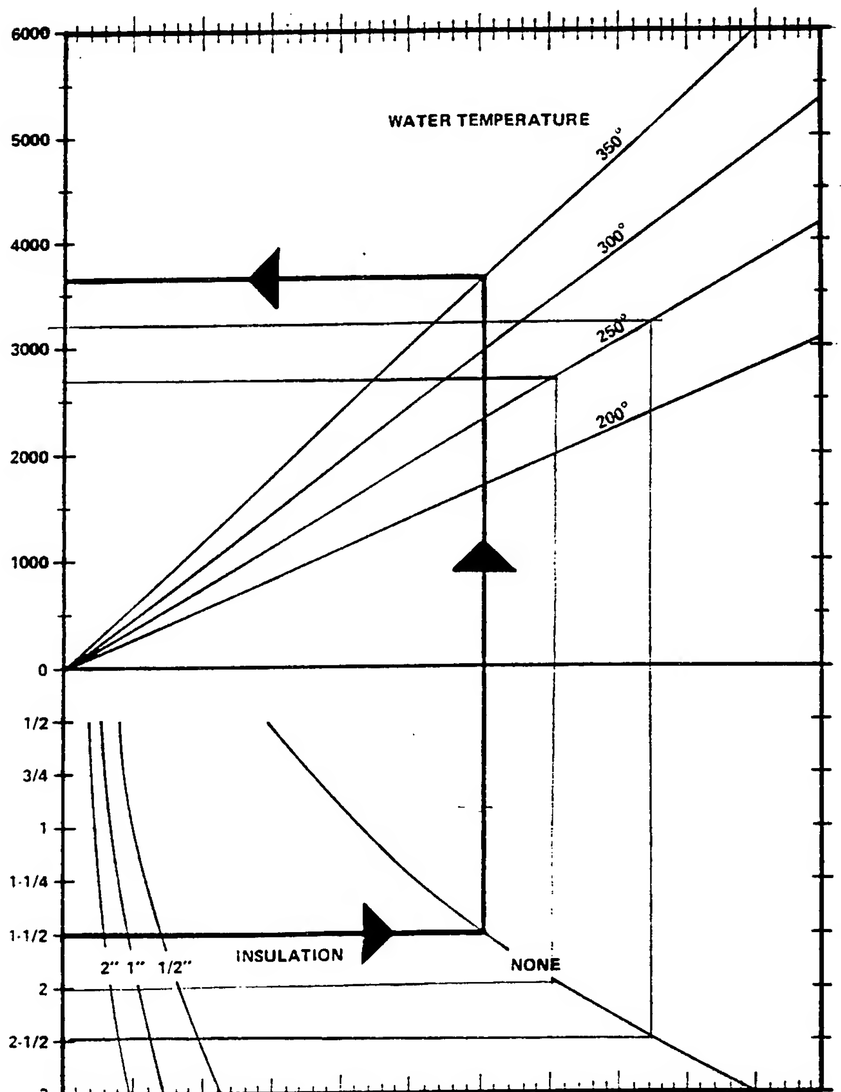
COMPUTATION SHEET

COMPUTED BY RWB	ECO # B-4	PROJECT 16-403-10
CHECKED BY BH	INSULATE PIPE & FITTINGS	FIT EEAP
DATE MARCH 1993		
REV. JUNE 1993	HEAT LOSS/GAIN CALCULATIONS	SHEET NO. 4 OF 20 SHEETS

ASSUMPTIONS

STEAM HEATING
250° AVE
USE DOE "ENERGY CONSERVATION IN
EXISTING BUILDINGS FIG. 8-48

ASSUME 1" INSULATION



FORM 101-1/8

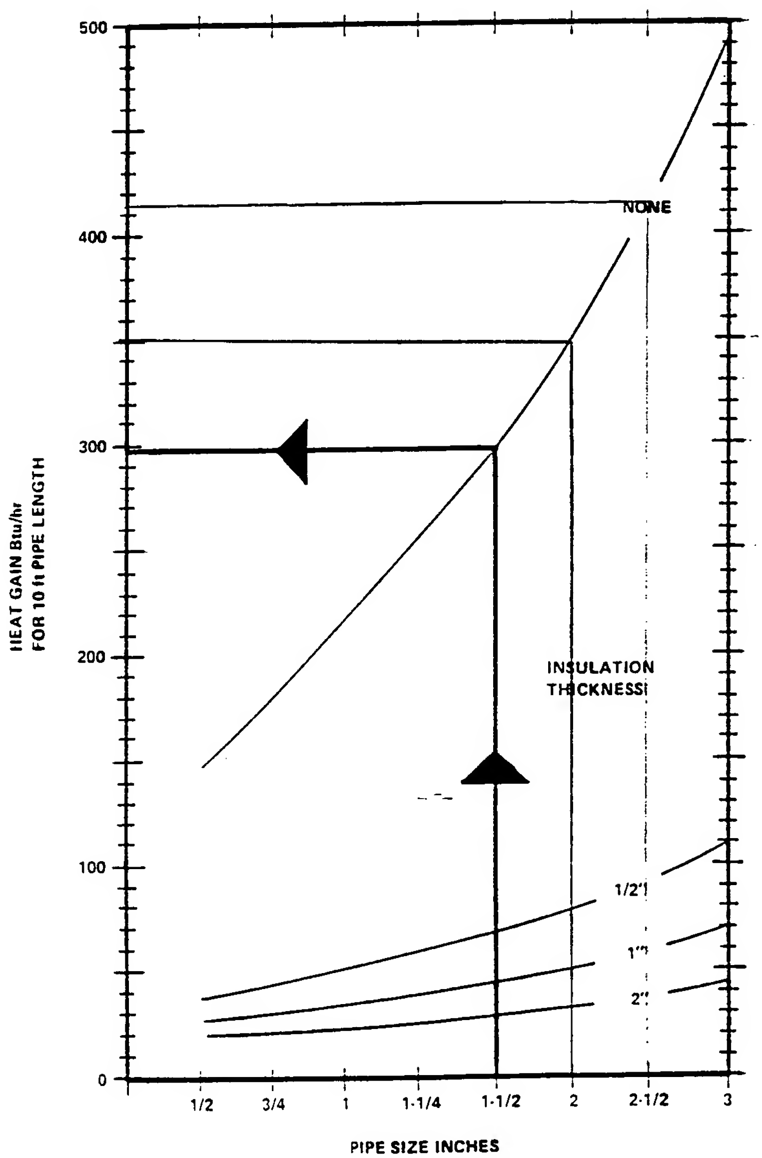
COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB CHECKED BY BIH DATE MARCH 1993 REV. JUNE 1993	ECO # B-4 INSULATE PIPE + FITTINGS HEAT LOSS/GAIN CALCULATIONS	PROJECT 16-403-10 FIN EEAP SHEET NO. 5 OF 20 SHEETS

ASSUMPTIONS
CHILLED WATER COOLING
ASSUME 45° WATER
USE REF. "ENERGY CONSERVATION IN EXISTING BUILDINGS FIG. 8.49

ASSUME 1" INSULATION



FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB	ECO # B-4	PROJECT 13-403-10
CHECKED BY KIH	INSULATE PIPE + FITTINGS	FTL EEAP
DATE MARCH 1993	HEAT LOSS SAVINGS $	SHEET NO. 6 OF 20 SHEETS
REV. JUNE 1993		

BLDG 6 - DOMESTIC HOT WATER ONLY

BLDG 80 - HOT WATER HEATING

1 1/2" PIPE @ 50 FT UNINSULATED

W/O INSULATION 150 BTU/HR, FT LOSS

W/ INSULATION 25 BTU/HR, FT LOSS

125 x 50 FT = 6.25 KBTUH

6.25 KBTUH x 59325 °HRS/(70°-24°)

8.06 MBTUH/YR / 68.5% EFF

= 11.8 MBTU/YR (PROPANE)

BLDG 81 HOT WATER HEATING

2" PIPE @ 20 FT UNINSULATED

W/O INSULATION 175 BTU/HR

W/ INSULATION 25 BTU/HR

150 BTU/HR x 20 FT = 3 KBTUH

3 KBTUH x 13581 °HRS/(70°-24°)

= 0.9 MBTU/YR / 74% = 1.2 MBTU/YR

BLDG 124 - DOMESTIC HOT WATER ONLY

FORM 101-1/8

COMPUTATION SHEET		**Keller & Gannon** Engineers-Architects
COMPUTED BY RLB CHECKED BY BHT DATE MARCH 1993 REV. JUNE 1993	ECO# B-4 INSULATE PIPE & FITTINGS HEAT LOSS SAVINGS 1	PROJECT 16-402-10 FTL FEAP SHEET NO. 7 OF 20 SHEETS

BLDG 127 - DOMESTIC HOT WATER ONLY

BLDG 131 - DOMESTIC HOT WATER ONLY

BLDG 190 - HOT WATER HEATING

1¼" PIPE & FITTINGS @ 15 FT EQUIVILENT LENGTH

W/O INSULATION 125 BTUH/FT
W/ INSULATION 20 BTUH/FT

105 BTUH/FT x 15 FT = 1.6 KBTUH

1.6 KBTUH x 32596°HRS/(70°-24°)

= 2.7 MBTU/YR / 73.7% = 3.7 MBTU/YR (OIL)

BLDG 197 - DOMESTIC HOT WATER ONLY

BLDG 206

	4" PIPE & FITTINGS	3" PIPE & FITTINGS	1½" PIPE & FITTINGS
	10 FT	15 FT	10 FT
W/O INSULATION	300 BTUH/FT	250 BTUH/FT	150 BTUH/FT
W/ INSULATION	75 BTUH/FT	60	25 BTUH/FT
	225 BTUH/FT	190 BTUH/FT	125 BTUH/FT
	x 10 FT	x 15 FT	x 10 FT
	2.3 KBTU	2.85 KBTU	1.3 KBTU

= 6.45 KBTU x 115562°HR (70°-24°)

= 16.2 MBTU/YR ÷ 70.8% EFF. = 22.9 MBTU/YR

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB	ECO # B-4	PROJECT 10-403-10
CHECKED BY BJH	INSULATE PIPE & FITTINGS	FTL EEAP
DATE MARCH 1993	HEATING LOSS SAVINGS $	SHEET NO. 8 OF 20 SHEETS
REV. JUNE 1993		

BLDG 207

HOT WATER HEATING

2 1/2" PIPE + FITTINGS @ 20 FT EQUIVELENT LENGTH

W/O INSULATION 200 BTUH/FT
W/ INSULATION 35 BTUH/FT

165 BTUH/FT x 20 FT = 3.3 KBTU

3.3 x 85,120°H/(70°-24°) = 6.1 MBTU/YR

6.1 ÷ 71.4 % = 8.5 MBTU/YR (OIL)

BLDG 208

8.5 MBTU/YR (SEE 207)

BLDG 209

HOT WATER HEATING

1 1/4" PIPE + FITTINGS @ 10 FT EQUIVILENT LENGTH

W/O INSULATION 125 BTUH/FT
W/ INSULATION 20 BTUH/FT

105 BTUH/FT x 10 FT = 1 KBTUH

1 x 71,527°HR/(70°-24°) = 1.5 MBTU/YR

1.5 ÷ 61.2 % = 2.5 MBTU/YR (PROPANE)

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BIH
DATE MARCH 1993
REV. JUNE 1993

ECO # B-4
INSULATE PIPE & FITTINGS
HEAT LOSS SAVINGS

PROJECT 16-403-10
FT. FEN...
SHEET NO. 9 OF 20 SHEETS

BLDG 212 DOMESTIC HOT WATER ONLY

BLDG 219
HOT WATER HEATING

	1 1/2" PIPE AND FITTINGS	3/4" PIPE & FITTINGS
W/O INSULATION	150 BTU/HR·FT	85
W/ INSULATION	25 BTU/HR FT	15
	125 BTU/HRFT × 10 FT	70 BTU/HRFT × 10 FT
	= 1.25 KBTUH	= 0.7 KBTUH

1.95 KBTUH × 85120° HR/(70° − 24°)

= 3.51 MBTU/HR ÷ 67% = 2.4 MBTU/HR (PROPANE)

BLDG 229
8.5 MBTU/HR (SEE BLDG 207)

BLDG 230
8.5 MBTU/HR (SEE BLDG 207)

FORM 101-1/8

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY RJB	ECO # B-4	PROJECT V6-453-10
CHECKED BY BHT	INSULATE PIPE FITTINGS	FTL FEAP
DATE MARCH 1993	HEAT LOSS/GAIN CALCULATIONS	SHEET NO. 10 OF 30 SHEETS
REV. JUNE 1993		

BLDG 238

HOT WATER HEATING
1 1/2" PIPE AND FITTINGS

W/O INSULATION 150 BTU/HR FT
W/ INSULATION 25 BTU/HR FT

125 BTU/HR FT x 10 FT = 1.25 KBTUH

1.25 KBTUH x 60,531°H / (70°-24°)
= 1.6 MBTUH/YR / 68.9% = 2.3 MBTUH (PROPANE)

BLDG 241

STEAM HEATING / CHILLED WATER COOLING

HEATING:
2 1/2" PIPE + FITTINGS

W/O INSULATION 325 BTUH/FT
W/ INSULATION 50 BTUH/FT

275 BTUH/FT x 10 FT = 2.75 KBTU

2.75 KBTUH x 60531° HR / (70°-24°)
= 3.6 MBTU/YR / 66.6% = 5.4 MBTU/YR (PROPANE)

COOLING
2" PIPE + FITTINGS

W/O INSULATION 35 BTUH/FT
W/ INSULATION 5 BTUH/FT

30 BTUH/FT x 10 FT = .3 KBTUH

ASSUME EER = 10 ∴ KWH = .03
.03 KWH x 15420° HR / (102-72°) = 15.4 KWH/YR (ELEC

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BH
DATE MARCH 1993
REV. JUNE 1993

ECO# B-4
INSULATE PIPE + FITTINGS

PROJECT 16-403-10
FTL EEAP

SHEET NO. 11 OF 20 SHEETS

BLDG 287 - DOMESTIC HOT WATER ONLY

BLDG 290
HW/HEATING CW/COOLING

~~HEATING~~
1"Ø PIPE + FITTINGS

W/O INSULATION 100 BTUH/FT
W/ INSULATION 20 BTUH/FT

80 BTUH/FT × 20F = 1.6 KBTUH

1.6 × 60,530°H / (70-24°) = 2.1 MBTU/YR
2.1 / 63.8% EFF = 3.3 MBTU/YR (PROPANE)

COOLING
2 1/2" PIPE + FITTINGS

W/O INSULATION 41 BTUH/FT
W/ INSULATION 6 BTUH/FT

35 BTUH/FT × 20 FT = 0.7 KBTUH

ΔKW = 0.7 / EER (ASSUME EER = 10) = 0.07 KW

0.07 KW (15420°H)(102°-72°) = 36 KWH/YR
(ELEC)

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RWB
CHECKED BY BH
DATE MARCH 1993
REV. JUNE 1993

ECO# B-4
INSULATE PIPE + FITTINGS
HEAT LOSS/GAIN CALCULATIONS

PROJECT 16-403-10
FTL EEAP
SHEET NO. 12 OF 20 SHEETS

BLDG 291

STEAM HEATING
2" PIPE + FITTINGS

W/O INSULATION 280 BTUH/FT
75 BTUH/FT
205 BTUH/FT x 10FT = 2.05 KBTUH

2.05 KBTUH x 6053 1°H (70°-24°) = 5.7 MBTU/YR
5.7 / 59.8 % = MBTU/YR

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 13 Of 20	
Project: EEAP Limited Energy Study	Project No.: !6-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO# B-4 (Insulate Pipe & Fittings)	Estimator: RJB	Checked By: BIH	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 80							
1-1/2" Pipe Insulation	50	LF	$2.50	$125	$2.00	$100	$225
Subtotal Bldg 80							$225
Building 81							
2" Pipe Insulation	20	LF	$3.00	$60	$4.00	$80	$140
Subtotal Bldg 81							$140
Building 190							
1-1/4" Pipe Insulation	15	LF	$2.50	$38	$2.00	$30	$68
Subtotal Bldg 190							$68
Building 206							
1-1/2" Pipe Insulation	10	LF	$2.50	$25	$2.00	$20	$45
3" Pipe Insulation	15	LF	$3.50	$53	$5.00	$75	$128
4" Pipe Insulation	10	LF	$3.60	$36	$6.00	$60	$96
Subtotal Bldg 190							$269
Building 207							
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$4.00	$80	$140
Subtotal Bldg 207							$140
Building 208							
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$4.00	$80	$140
Subtotal Bldg 208							$140
Building 209							
1-1/4" Pipe Insulation	10	LF	$2.50	$25	$2.00	$20	$45
Subtotal Bldg 209							$45
Building 219							
3/4" Pipe Insulation	10	LF	$2.50	$25	$2.00	$20	$45
1-1/2" Pipe Insulation	10	LF	$2.50	$25	$2.00	$20	$45
Subtotal Bldg 219							$90

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet 14 Of 20	
Project	EEAP Limited Energy Study
Project No.	16-403-10
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO# B-4 (Insulate Pipe & Fittings)
Estimator	RJB
Checked By	BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 229							
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$4.00	$80	$140
Subtotal Bldg 229							$140
Building 230							
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$4.00	$80	$140
Subtotal Bldg 230							$140
Building 238							
1-1/2" Pipe Insulation	10	LF	$2.50	$25	$2.00	$20	$45
Subtotal Bldg 238							$45
Building 241							
2-1/2" Pipe Insulation	10	LF	$3.00	$30	$4.00	$40	$70
2" Pipe Insulation	10	LF	$3.00	$30	$4.00	$40	$70
Subtotal Bldg 241							$140
Building 290							
1" Pipe Insulation	20	LF	$2.50	$50	$2.00	$40	$90
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$4.00	$80	$140
Subtotal Bldg 290							$230
Building 291							
2" Pipe Insulation	10	LF	$3.00	$30	$4.00	$40	$70
Subtotal Bldg 291							$70

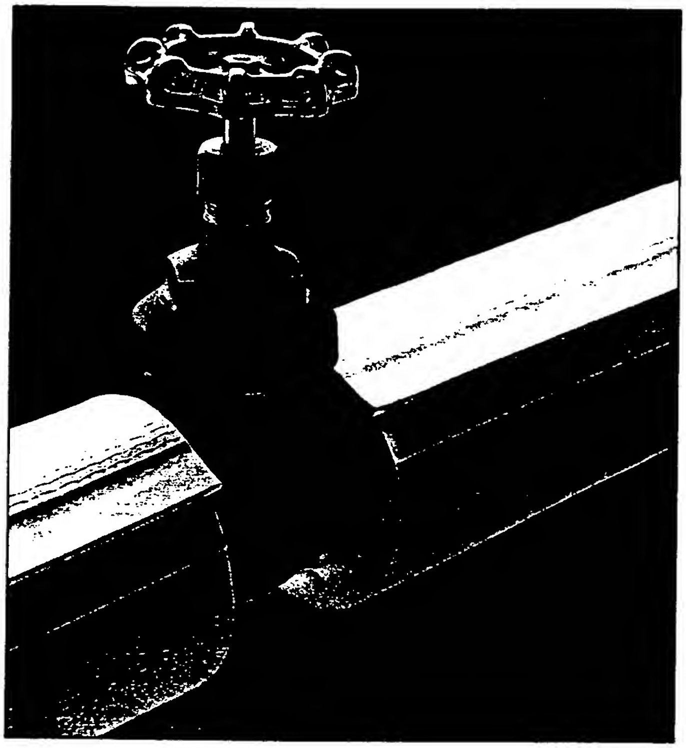
CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 15 of 20
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO# B-4 (Insulate Pipe & Fittings)	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 80	Removable Insulation						
1-1/2" Pipe Insulation	50	LF	$2.50	$125	$5.22	$261	$386
Subtotal Bldg 80							$386
Building 81	Removable Insulation						
2" Pipe Insulation	20	LF	$3.00	$60	$5.77	$115	$175
Subtotal Bldg 81							$175
Building 190	Removable Insulation						
1-1/4" Pipe Insulation	15	LF	$2.50	$38	$5.04	$76	$113
Subtotal Bldg 190							$113
Building 206	Removable Insulation						
1-1/2" Pipe Insulation	10	LF	$2.50	$25	$5.41	$54	$79
3" Pipe Insulation	15	LF	$3.50	$53	$6.35	$95	$148
4" Pipe Insulation	10	LF	$3.60	$36	$7.08	$71	$107
Subtotal Bldg 190							$334
Building 207	Removable Insulation						
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$5.97	$119	$179
Subtotal Bldg 207							$179
Building 208	Removable Insulation						
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$5.97	$119	$179
Subtotal Bldg 208							$179
Building 209	Removable Insulation						
1-1/4" Pipe Insulation	10	LF	$2.50	$25	$5.04	$50	$75
Subtotal Bldg 209							$75
Building 219	Removable Insulation						
3/4" Pipe Insulation	10	LF	$2.50	$25	$4.66	$47	$72
1-1/2" Pipe Insulation	10	LF	$2.50	$25	$5.22	$52	$77
Subtotal Bldg 219							$149

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 16 of 20
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO# B-4 (Insulate Pipe & Fittings)	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 229	Removable Insulation						
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$5.97	$119	$179
Subtotal Bldg 229							$179
Building 230	Removable Insulation						
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$5.97	$119	$179
Subtotal Bldg 230							$179
Building 238	Removable Insulation						
1-1/2" Pipe Insulation	10	LF	$2.50	$25	$5.22	$52	$77
Subtotal Bldg 238							$77
Building 241	Removable Insulation						
2-1/2" Pipe Insulation	10	LF	$3.00	$30	$5.97	$60	$90
2" Pipe Insulation	10	LF	$3.00	$30	$5.59	$56	$86
Subtotal Bldg 241							$176
Building 290	Removable Insulation						
1" Pipe Insulation	20	LF	$2.50	$50	$4.85	$97	$147
2-1/2" Pipe Insulation	20	LF	$3.00	$60	$5.97	$119	$179
Subtotal Bldg 290							$326
Building 291							
2" Pipe Insulation	10	LF	$3.00	$30	$5.59	$56	$86
Subtotal Bldg 291							$86



For Light Duty Applications on Hot And Cold Surfaces

TMZ 175 Jacketed Flexible Polyurethane Foam Pipe Insulation

Use on Temperatures from –65°F to +220°F

Description: Thermazip® 100 Series consists of foam insulation laminated to a lightweight reinforced jacket. A patented locking trac, factory applied to the jacket, is used to snap Thermazip® on the pipe.

Uses and Applications: Suitable for light duty indoor applications on both hot and cold surfaces. Chemical resistance, plus ability to withstand repeated cleaning with detergents, makes this an excellent product for use where a clean appearance is important. Thermazip® 100 is used to insulate hot and cold pipes; control sweating and dripping pipes; protect personnel from burns; color code pipes; and control temperature of process liquids. Typical end users are: laundries, hospitals schools, offices and commercial buildings.

Available Forms: Available in standard 4-foot lengths or pre-cut to your specific requirements up to 25 feet to fit pipe and tube sizes up to 6 inches. Polyurethane foam insulation is standard in 1/2, 1 and 1 1/2 inch thicknesses.

ECO B4
SHEET 17 OF 2C

Thermazip® Insulation Options and Specifications

TMZ 100 Jacket

Description and Specification: Thermazip® 100 jacket is made of a strong polyester scrim laminated between 2 layers of PVC which provides excellent resistance to chemicals. The total thickness is .016 inches. Standard color is white, but red, blue, yellow or green is available.

Jacket Material and Properties	Values
Polyvinylchloride	.016 inches
Polyester Fabric	11 x 11 scrim
Total Weight	10 oz./sq. yd.
Ambient Temperature Range	+40°F to +150°F
Tensile Strength	Warp: 120 lbs./in.
(Fed. Method 191, 5100)	Fill: 80 lbs./in.
Tear Strength	Warp: 24 lbs.
(Fed. Method 191, 5134)	Fill: 25 lbs.
Cold Crack (Fed. Method 191, 5204)	+10°F
Fire Hazard Classification	Self Extinguishing
(Fed. Method 191, 5903.2)	2 sec. max

Polyurethane Foam Type 75 Insulation

Description and Specification: The polyurethane foam used in the manufacture of Thermazip® is a highly stabilized polymeric material. Its physical properties are locked in so it resists further chemical reaction with elements in the environment. It is highly resistant to fungi and bacterial growth. It is formulated to meet nationally recognized flammability tests.

Insulation Material	Polyurethane Foam
Density	1.2 lbs./cu. ft.
Indent Load Deflection (25%)	20 lbs.
K Factor @ +75°F	0.27 BTU/hr/sq ft/°F/in
Service Temperature	–65°F to +220°F
Fire Hazard Classification:	
California Bulletin #117	Pass
ASTM-D-1692 (UL Subject 94)	Pass
FAA 60 Second Vertical Burn	Pass
MVSS-302 Horizontal Burn	Pass

Accessible Products Co. • 2122 W. 5th Pl. • Tempe, AZ 85281-9990 • 602-967-8888 • 1-800-922-5252 • FAX 602-894-6255

Thermazip 100 Series Pipe Insulation

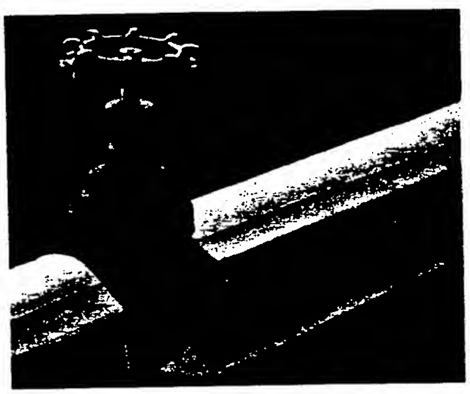
TMZ 175

Price List — Effective September 1, 1992 — Price Per Linear Foot

TMZ 100 Jacket Specifications

Jacket Description and Specification: Thermazip 100 jacket is made of a strong polyester scrim laminated between 2 layers of PVC which provides excellent resistance to chemicals. The total thickness is .016 inches. Standard color is white, but red, blue, yellow or green is available.

Jacket Material and Properties	Values
Polyvinylchloride	.016 inches
Polyester Fabric	11 x 11 scrim
Total Weight	10 oz./sq./yd.
Ambient Temperature Range	+40°F to +150°F
Tensile Strength	Warp: 120 lbs./in.
(Fed. Method 191, 5100)	Fill: 80 lbs./in.
Tear Strength	Warp: 24 lbs./in.
(Fed. Method 191, 5134)	Fill: 25 lbs./in.
Cold Crack (Fed. Method 191, 5204)	+10°F
Fire Hazard Classification (Fed. Method 191, 5903.2)	Self Extinguishing



Description: Thermazip 100 Series consists of foam or fiberglass insulation laminated to a lightweight reinforced jacket. A patented locking trac, factory applied to the jacket, is used to snap Thermazip on the pipe.

Thermazip Polyurethane Foam 75

The polyurethane foam used in the manufacture of Thermazip is a highly stabilized polymeric material. Its physical properties are locked in so it resists further chemical reaction with elements in the environment. It is highly resistant to fungi and bacterial growth. It is formulated to meet nationally recognized flammability tests.

Insulation Material	Polyurethane Foam
Density	1.2 lbs./cu. ft.
Indent Load Deflection 25%	20 lbs.
K Factor @ +75°F	0.27 BTU/hr./sq. ft./°F/in.
Service Temperature	–65°F to +220°F
Fire Hazard Classification:	
California Bulletin #117	Pass
ASTM-D-1692 (UL Subject 94)	Pass
FAA 60 Second Vertical Burn	Pass
MVSS-302 Horizontal Burn	Pass

CONVERSION CHART				GUIDE	TMZ 175 Polyurethane Insulation		
					Convoluted		
Iron Pipe	Copper Tubing	Stnlss Tubing	TMZ Size		1/2"	1"	1 1/2"
1/4	3/8	1/2	1/2	A	3.43	4.38	
3/8	1/2		5/8	B	3.48	4,47	
	5/8		3/4	C	3.57	4.57	
1/2	3/4		7/8	D	3.65	4.66	
3/4		1	1	E	3.73	4.75	6.03
	1		1 1/8	F	3.79	4.85	6.14
1	1 1/4		1 3/8	G	3.94	5.04	6.36
		1 1/2	1 1/2	H	4.03	5.13	6.47
1 1/4	1 1/2		1 5/8	I	4.09	5.22	6.58
1 1/2			1 7/8	J	4.26	5.41	6.81
		2	2	K	4.32	5.51	6.91
	2		2 1/8	L	4.40	5.59	7.01
2			2 3/8	M	4.55	5.77	7.25
		2 1/2	2 1/2	N	4.62	5.88	7.35
	2 1/2		2 5/8	O	4.70	5.97	7.46
2 1/2			2 7/8	P	4.85	6.16	7.68
		3	3	Q	4.92	6.24	7.79
	3		3 1/8	R	5.00	6.35	7.90
3			3 1/2	S	5.23	6.62	8.23
	3 1/2		3 5/8	T	5.31	6.72	8.34
		4	4	U	5.53	7.00	[illegible]
	4		4 1/8	V	5.61	7.08	[illegible]
4			4 1/2	W	5.83	7.37	9.11
		5	5	X	6.14	7.74	9.55
	5		5 1/8	Y	6.22	7.84	9.67
5			5 1/2	Z	6.44	8.12	9.99
		6	6	AA	6.75	8.50	10.43
	6		6 1/8	BB	6.82	8.58	10.55
6			6 5/8	CC	7.13	8.96	11.75
		8	8	DD			
	8		8 1/8	EE			
8			8 5/8	FF			
		10	10	GG			
10			10 3/4	HH			
		12	12	II			
12			12 3/4	JJ			
14		14	14	KK			
16		16	16	LL			
18		18	18	MM			
20		20	20	NN			
22		22	22	OO			
24		24	24	PP			

- Pipe insulation is standard in 4-foot sections and includes free butt strips required for installation.
- Jacket Colors Available: Red, Blue, Yellow, Green, White.
- See the fitting cover price list for matching insulating fitting covers and [illegible].
- For other accessories, see our Thermazip® accessories price list.

ACCESSIBLE PRODUCTS COMPANY

2122 West 5th Place, Tempe, Arizona 85281 • (602) 967-8888 • 1-800-922-5252 • FAX 1-602-894-6255

REVISED JUNE 1993

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B4
Sheet ~~8~~ of ~~8~~
19 20

Location: Fort Hunter Liggett, California Region No. 4 Project No. 16-403-10
Project Title: Insulate Pipes & Fittings Fiscal Year FY96
Discrete Portion Name: ECO# B-4 (Standard Insulation)
Analysis Date: March 1993 Economic Life: 15 YEARS Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$2,794		
B. SIOH	$154		
C. Design Cost	$168		
D. Total Cost (1A+1B+1C)	$3,115		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$3,115

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0.1	$0.96	11.70	$11
B. Dist	$4.98	60.6	$301.79	13.78	$4,159
C. Propane	$7.87	39.1	$307.72	14.16	$4,357
D. Demand	$108.60	0.0 kW	$0.00	11.70	$0
E. Other					
F. Total			$610		$8,527

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($70)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($777)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) ($777)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	5.8	Years
5. Total Net Discounted Savings (2F5+3C):	$7,750	
6. Savings to Investment Ratio (SIR) 5/1G:	2.49	RECOMMENDED
7. Adjusted Internal Rate of Return (AIRR):	10.51%	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B4
Sheet ~~8~~ of ~~8~~
20 20

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: Insulate Pipes & Fittings   Fiscal Year FY96
Discrete Portion Name: ECO# B-4 (Removable Type Insulation)
Analysis Date: June 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$3,378		
B. SIOH	$186		
C. Design Cost	$203		
D. Total Cost (1A+1B+1C)	$3,766		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$3,766

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0.1	$0.96	11.70	$11
B. Dist	$4.98	60.6	$301.79	13.78	$4,159
C. Propane	$7.87	39.1	$307.72	14.16	$4,357
D. Demand	$108.60	0.0 k	$0.00	11.70	$0
E. Other					
F. Total			$610.46		$8,527

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($68)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($751)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.	$1,883	10	0.67	$1,262
b.				
c.				
d. Total	$1,883	10		$1,262

C Total Non Energy Discounted Savings (3A2+3Bd4) $510

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	5.6	Years
5. Total Net Discounted Savings (2F5+3C):	$9,038	
6. Savings to Investment Ratio (SIR) 5/1G:	2.40	
7. Adjusted Internal Rate of Return (AIRR):	10.25%	

NOT RECOMMENDED

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY RJE CHECKED BY [illegible] DATE MARCH 1982 REV. 19__	ECO # 12-5 [illegible]	PROJECT V-403-10 [illegible] SHEET NO. 1 OF 6 SHEETS

DESCRIPTION OF ACTION

Reducing the hot water supply temperature by adjusting hot water boiler set points reduces conduction losses from piping and slightly improves boiler performance. Control retrofits consist of differential temperature controllers that adjust hot water boiler set points proportionally in the range of 200 °F to 180 °F when outside air temperatures are between 40°F and 65°F. Existing heating hot water supply temperatures are used when outside air temperatures are below 40°F. No heating is allowed for outside air temperatures above 65°F.

FACILITIES INCLUDED

All buildings heated using hot water boilers are considered.

ENERGY SAVING CALCULATIONS

BOILER PERFORMANCE IMPROVEMENT

Formula to calculate Heat Transfer, comb. Gasses to circ Heating Hot water in Boiler Tubes: $k = f(\text{BTU}/\Delta T\text{-inch-SQ FT})$

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY BJH
DATE MARCH 1993
REV. 19__

ECO # B-5
OUTSIDE AIR TEMPERATURE RESET

PROJECT K6-403-10
FTL FEAP

SHEET NO. 2 OF 6 SHEETS

Lowering HHW Temp. will result in the same boiler k: $k_1 = k_2$ since thickness (inches) and area (SQ FT) remain constant, thus

$$BTUH_2 / \Delta T_2 = BTUH_1 / \Delta T_1$$

$$BTUH_2 = (\Delta T_2 / \Delta T_1)\ BTUH_1$$

represents increased heat transfer efficiency.

where:

$$\Delta T_1 = 750°F - \left\{ \frac{200+180}{2} \right\} = 560°F$$

$$\Delta T_2 = 750°F - \left\{ \frac{180+160}{2} \right\} = 580°F$$

ΔT_1 = Comb. temp. less HHW Avg Temp. (200°F Supply, 180°F Return assumed 20°F ΔT HHW)

ΔT_2 = same as ΔT_1 except reduced to 180°F supply & 160°F Return.

NOTE: RETURN TEMP MINIMUM 160°F TO PREVENT CONDENSING IN BOILER.
AVG. TEMP IN BLR 750°F.

$$BTUH_2 = 580/560\ BTUH_1$$

$$= 1.0357 \Rightarrow$$

3.57% efficiency improvement @ 65°F OSA.

AVG. EFF. IMPROVEMENT:

$$3.57 \times \frac{\text{DEG HRS. BETWEEN } 40 \text{ \& } 65°F}{\text{DEG HRS BELOW } 65°F}$$

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RJB CHECKED BY BJH DATE MARCH 1993 REV. 19__	ECO # B-5 OUTSIDE AIR TEMPERATURE RESET	PROJECT K6-403-10 FT. IRAP SHEET NO. 2 OF 6 SHEETS

Lowering HHW Temp. will result in the same boiler k: $k_1 = k_2$ since thickness (inches) and area (SQ FT) remain constant, thus

$$BTUH_2 / \Delta T_2 = BTUH_1 / \Delta T_1$$

$$BTUH_2 = (\Delta T_2 / \Delta T_1)\ BTUH_1$$

represents increased heat transfer efficiency.

where: $\Delta T_1 = 750°F - \left\{ \frac{200+180}{2} \right\} = 560°F$

$\Delta T_2 = 750°F - \left\{ \frac{180+160}{2} \right\} = 580°F$

ΔT_1 = Comb. temp. less HHW Avg Temp. (200°F Supply, 180°F Return assumed 20°F ΔT HHW)

ΔT_2 = same as ΔT_1 except reduced to 180°F supply & 160°F Return.

NOTE: RETURN TEMP MINIMUM 160°F TO PREVENT CONDENSING IN BOILER.
AVG. TEMP IN BLR 750°F.

$$BTUH_2 = 580/560\ BTUH_1$$
$$= 1.0357 \Rightarrow$$

3.57% efficiency improvement @ 65°F OSA.

AVG. EFF. IMPROVEMENT:

$$3.57 \times \frac{\text{DEG HRS. BETWEEN } 40 \text{ \& } 65°F}{\text{DEG HRS BELOW } 65°F}$$

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY BIH
DATE MARCH 1993
REV. 19__

ECO# B-5
H/A TEMPERATURE RESET

PROJECT 16-405-10
FT. FEAP

SHEET NO. 3 OF 6 SHEETS

CONDUCTION LOSSES

200°F 2"ϕ, 2" INSULATION 180 BTUH / 10 LF

180°F —— " —— 160 —— " ——

160°F —— " —— 120 —— " ——

SAVINGS : $1 - \left[\frac{(180-120)}{(180-160)}\right]$ = 33% of conduction losses

after other insulation retrofits, no more than 1% of boiler efficiency involves conduction losses, Max 0.33%

O&M COST

Allow 2 MH / YR / CONTROL SYSTEM & MECHANICAL - HEATING
@ $3.54 / HR = $7.08 / HR

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY R.J.B.
CHECKED BY R.I.H.
DATE MARCH 1993
REV. 19

ECO# B-5
OUTSIDE AIR TEMP RESET
ENERGY SAVINGS CALCS

PROJECT 16-403-10
FHL EEAP

SHEET NO. 4 OF 6 SHEETS

ALL BUILDINGS EXAMINED CURRENTLY HAVE OUTSIDE AIR TEMPERATURE RESET CONTROL ON HOT WATER BOILERS. WITH THE EXCEPTION OF BUILDING 101.

BLDG 101

BOILER SIZE = 300 KBTUH

SAVINGS:

AVG EFFICIENCY IMPROVEMENT $= 3.57 \times \frac{5161}{96632}$

$= 0.19\%$

$+ 0.33\%$ CONDUCTION LOSS

0.52%

CURRENT BOILER EFFICIENCY = 67.9%

EFFICIENCY W/ECO = 68.42%

Δ INPUT BTUH $= \frac{300}{0.679} - \frac{300}{0.6842} = 3.34$ KBTU

3.34 KBTU × 96632 °H / (70° − 24°) = 7 MBTU/YR

7 MBTU/YR × \$4.98/YR = \$35/YR

@ 15 YRS (UPW = 11.12) TOTAL SAVINGS = \$389

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 5 Of 6
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO#-B5 (Outside Air Temperature Reset)	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Controller	1	EA	$39	$39	$450	$450	$489
Remove Old Control	1	EA	$39	$39			$39
Wiring	1	Lot	$150	$150	$30	$30	$180
Subtotal							$708
Sales Tax @ 8%							$57
Subtotal							$765
Contractor OH & Profit @ 30%							$229
Subtotal							$994
Bond @ 1%							$10
Subtotal							$1,004
Estimating Contingency @ 10%							$100
Total Probable Construction Cost							$1,104

Life Cycle Cost Analysis Summary — ECO B-5

Energy Conservation Investment Program (ECIP) — Sheet 6 of 6

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10

Project Title: Install Outside Air Temperature Reset — Fiscal Year FY96

Discrete Portion Name: ECO# B-5

Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$1,104		
B. SIOH	$61		
C. Design Cost	$66		
D. Total Cost (1A+1B+1C)	$1,231		
E. Salvage Value of Existing Equipment			
F. Public Utility Company Rebate			
G. Total Investment (1D-1E-1F)			$1,231

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84		$0	11.70	$0
B. Dist	$4.98	7	$35	13.78	$480
C. Propane	$7.87		$0	14.16	$0
D. Other					
E. Demand Savings					
F. Total			$35		$480

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($7)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($78)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) — ($78)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	44.2	Years
5. Total Net Discounted Savings (2F5+3C):	$403	
6. Savings to Investment Ratio (SIR) 5/1G:	0.33	
7. Adjusted Internal Rate of Return (AIRR):	-11.17%	

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB/BIH CHECKED BY BIH/RJB DATE MARCH 1993 REV. 19	ECO B6/B7 INSTALL TIME CLOCKS OR PROGRAMMABLE T-STATS	PROJECT 16-403-10 FHL-EEAP SHEET NO. 1 OF 15 SHEETS

DESCRIPTION OF ACTION

Install programmable T-stats or 7-day, 24-hour time clocks to control HVAC systems in selected buildings. Assure that simultaneous heating and cooling do not occur and provide a dead-band between heating and cooling set point temperatures.

Facilities Included

Refer to attached spreadsheet printouts

Energy Saving Calculations

Two categories of calculations are used:

Buildings whose HVAC energy use are simulated using Trace 600 computer program were re-run with revised temperature schedules and lock-outs of simultaneous heating and cooling.

Remaining building energy savings were determined based on baseline HVAC energy use estimates factored down by the ratio of full-load-hours before and after the retrofit.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BHT
DATE FEB 1983
REV. 19

ECO# B-6/7
INSTALL TIME CLOCKS
TRACE 600 ASSUMPTIONS

PROJECT 16-403-10
FT. BENNING

SHEET NO. 2 OF 15 SHEETS

TRACE 600

BUILDING	OCCUPANCY SCHEDULE		SYSTEM MODEL
46 **	HR	OCCUPANCY	PACKAGED, INDOOR TERMINAL AIR CONDITIONER WITH DOMESTIC PROPANE FIRED FURNACE: 28.5 MBH CLNG/58 MBH HEATING
	0-6	NO	
	6-20	YES	
	20-0	NO	
51 **	0-6	NO	2X PACKAGED, INDOOR TERMINAL AIR CONDITIONER WITH DOMESTIC PROPANE FIRED FURNACE EACH 21.2 MBH CLNG/ 33 MBH HEATING
	6-20	YES	
	20-0	NO	
128 **	0-11	YES	TWO PIPE FAN COIL UNITS (1 PER ROOM). COOLING PROVIDED BY (1) 280 MBH RECIPROCATING CHILLER, HEATING PROVIDED BY (1) 288 MBH PROPANE FIRED WATER HEATER
	11-13	NO	
	13-18	YES	
	18-20	NO	
	20-0	YES	
177	WEEKDAY		(1) PACKAGED ELECTRIC COOLED/ GAS HEATING UNIT
	0-9	NO	
	9-17	YES	
	17-24	NO	
	WEEKEND		
	OFF		
182	WEEKDAY		
	0-9	NO	(1) PACKAGED, ROOFTOP ELECTRIC COOL/GAS HEAT UNIT (UNDER 15 TONS)
	9-17	YES	
	17-24	NO	
	WEEKEND		
	OFF		

RM 101-1/8

ECO-B6

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY DH
DATE FEB 1983
REV. 19

ECO # B-6/7
INSTALL TIME CLOCKS
TRACE 600 ASSUMPTIONS CONT.

PROJECT 16-403-10
FIN. EEAP

SHEET NO. 3 OF 15 SHEETS

BUILDING	OCCUPANCY SCHEDULE HR	OCCUPANCY	SYSTEM MODEL
290	WEEK DAY		(1) SINGLE ZONE SYSTEM COOLED BY 25 TON RECIP CHILLER AND HEATED BY 816 MBH GAS FIRED HOT WATER HEATER. (3) 1.5 TON PACKAGED UNITS; (1) UNIT HEATER
	0-9	NO	
	9-17	YES	
	17-0	NO	
	WEEK END	OFF	
295 **	0-11	YES	(1) FAN COIL SYSTEM (1 PER ROOM) COOLED BY (1) 54 TON AIR COOLED RECIP CHILLER AND HEATED BY (1) 2600 MBH GAS FIRED HOT WATER HEATER
	11-13	NO	
	13-18	YES	
	18-20	NO	
	20-24	YES	
301 ***	WEEK DAY		(1) MULTIZONE SYSTEM COOLED BY (1) 143 MBH AIR COOLED CONDENSER AND HEATED BY (1) 137 MBH GAS FURNACE. SEVERAL COMPUTER ROOM AIR CONDITIONING UNITS W/ELECTRIC COOLING AND REHEAT
	0-8	NO	
	8-20	YES	
	20-24	NO	
	WEEKEND	OFF	

** PART OF ECO # B-7

*** COMPUTER ROOM IS AIR CONDITIONED 24 HRS/DAY EVERY DAY

FORM 101-1/8

ECO B-6

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BIH
DATE FEB 1993
REV. 19__

ECO # B-6/7
PROGRAMMABLE T-STAT
TRACE 600 ASSUMPTIONS

PROJECT 16-403-10
FHL EEAP

SHEET NO. 4 OF 15 SHEETS

BUILDING	T-STAT SCHEDULE			SYSTEM MODEL
46	HR	HTG	CLG	PACKAGED, INDOOR TERMINAL AIR CONDITIONER WITH DOMESTIC PROPANE FIRED FURNACE 28.5 MBH COOLING / 58 MBH HEAT
	0-6	55	88	
	6-20	68	78	
	20-0	55	88	
51	0-6	55	88	2X PACKAGED, INDOOR TERMINAL AIR CONDITIONER WITH DOMESTIC PROPANE FIRED FURNACE EACH 21.2 MBH COOLING / 38 MBH HEAT
	6-20	68	78	
	20-0	55	88	
121	0-8	55	88	(1) PACKAGED ELECTRIC COOLED / GAS HEAT UNIT (UNDER 20 TONS); (1) ELECTRIC COOLED / ELECTRIC HEAT WALL AC UNIT (UNDER 11 TONS)
	8-22	55	78	
	22-0	55	88	
128	WEEKDAY			TWO PIPE FAN COIL UNITS (ONE PER ROOM). COOLING PROVIDED BY (1) 230 MBH RECIPROCATING CHILLER, HEATING PROVIDED BY (1) 288 MBH PROPANE FIRED WATER HEATER
	0-11	65	78	
	11-13	55	88	
	13-18	65	88	
	18-20	55	88	
	20-0	65	78	
	WEEKEND			
	0-24	65	78	
177**	WEEKDAY			(1) PACKAGED ELECTRIC COOLED / GAS HEAT UNIT
	0-9	55	88	
	9-17	65	78	
	17-0	55	88	
	WEEKEND			
	0-24	55	88	(1) PACKAGED, ROOFTOP ELECTRIC COOLED / GAS HEAT UNIT (UNDER 15 TONS)
182**	0-9	55	88	
	9-17	65	78	
	17-24	55	88	

ECO B-7

ORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BH
DATE FEB 1993
REV. 19

ECO# B-6/7
PROGRAMMABLE T-STAT
TRACE 600 ASSUMPTIONS CONT

PROJECT 10-403-10
FTL EEAP
SHEET NO. 5 OF 15 SHEETS

BUILDING	T-STAT SCHEDULE			SYSTEM MODEL
	WEEK DAY			
	HR	HTG	CLG	
290 **	0-9	55	88	(1) SINGLE ZONE SYSTEM COOLED BY 25 TON RECIP. CHILLER + HEATED BY 816 MB GAS FIRED HOT WATER HEATER; (3) 1.5 TON PACKAGED UNITS; (1) UNIT HEATER.
	9-17	65	78	
	17-0	55	88	
	WEEKEND			
	0-24	55	88	
	WEEK DAY			
291	0-9	55	88	(1) ONE FAN COIL AND (1) PACKAGED TERMINAL AIR CONDITIONER COOLED BY AIR COOLED CONDENSER AND HEATED BY 240 MBH STEAM BOILER
	9-17	65	78	
	17-0	55	88	
	WEEKEND			
	0-24	55	88	
	WEEK DAY			
295	0-11	65	88	(1) FAN COIL SYSTEM (1 PER ROOM) COOLED BY 1,54 TO AIR COOLED RECIP CHILLER AND HEATED BY 1,2600 MBH GAS FIRED HOT WATER HEATER
	11-13	55	78	
	13-18	65	78	
	18-20	55	78	
	20-24	65	88	
	WEEK END			
	0-24	65	78	

** CONSIDERED AS PART OF ECO# B-6

FORM 101-1/8

ECO B-7

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RWB
CHECKED BY BHH
DATE FEB 1993
REV. 19__

ECO # B-617
PROGRAMMABLE T-STAT
ANNUAL O&M / TRAINING $

PROJECT 16-403-10
FTL EEAP

SHEET NO. 51 OF 15 SHEETS

ASSUME (1) INITIAL TRAINING SESSION WITH ANNUAL BULLETIN INSTRUCTIONS TO ALL FACILITIES WITH PROGRAMMABLE THERMOSTATS.

- 1 SESSION 4 HRS* @ $80.00/HR = $320.00
- ANNUAL BULLETIN $100.00/YR, 15 YRS = $1,112.00**

$1,432.00

ROUNDED $1,400.00

* INCLUDES TRAVEL.

** UPW FACTOR FROM TABLE A OF 10/92 NISTIR 85-3273-X @ 4% IS 11.12

ALLOCATE $320/15 YEARS + $100/YR = $121/YR TO BUILDINGS ASSOCIATED WITH THIS ECO; ASSUME TRAINING PER 20 "STATS" ∴ EXPENSE $121/20 = $6.05/YR PER STAT FOR TRAINING

RM 101-1/8

ECO B-7/6

ECO B6/7
Sheet 6 of 15

Fac No.	Installation Name	Existing Schedule Time HVAC ON	Time HVAC OF	Heating Season Setpoint Deg F	Setback Deg F	Cooling Setpoint Deg F	Degree Hours per Year, 7 Days/Wk Heating ON	Heating Set-Back	Htg Setbk 7 Day/Wk	Total Heating	Total Cooling	FULL LOAD HOURS/YEAR Heating FLHr/Yr	Cooling FLHr/Yr
T 6	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 41A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 41B	Family Housing NCO & Enl												
P 42A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 42B	Family Housing NCO & Enl												
P 43A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 43B	Family Housing NCO & Enl												
P 44A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 44B	Family Housing NCO & Enl												
P 45A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 45B	Family Housing NCO & Enl												
P 46	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 47	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 51A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 51B	Family Housing NCO & Enl												
P 52A	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 52B	Family Housing NCO & Enl												
P 53	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 54	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 55	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 56	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 57	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 58	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 59	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
P 60	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
S 79	Post Office, Main	900	1700	65	55	72	14,071	40,610	44,615	53,242	18,106	436	517
P 80	Exchange, Main Retail	900	1700	68	55	72	18,715	40,610	44,615	59,325	18,106	425	604
P 81	Theater with Dressing Rm's	1600	2300	65	55	72	19,809	5,000	5,161	13,581	9,650	277	138
P 101	Open Din Cons (Hacienda)	1000	1600	70	55	72	14,616	42,688	44,615	57,304	15,420	318	514
	Club (Bar)	1600	2200	70	55	72	21,855	40,134	44,615	61,989	9,650	475	322
	Hacienda, East Rooms	1700	800	70	55	NA	98,616	7,025	44,615	105,641	NA	2,144	0
	Hacienda, West Rooms												
P 116	Exchange Service Station	600	1900	60	40	NA	26,821	3,537	5,161	30,357	NA	745	0
	(Non-shop areas)	600	1900	68	40	72	47,065	3,537	5,161	50,602	21,102	1,070	703
T 120	Fire Station - Office	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
	Fire Station - Dorm												
	Fire Station - Garage												
T 121	Bowling Center	800	2200	68	55	72	42,842	33,140	44,615	67,020	21,833	911	520
T 124	Family Housing LC & MJ	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
T 127	Officers Quarters Military	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
P 128	Officers Quarters Military	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
T 131	Family Housing CG & WO	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
S 144	Gymnasium	Not in Use		Not in Use				Not in Use					
S 146	FE Facility	700	1600	55	40	78	10,781	3,537	5,161	11,702	9,003	281	268
T 149	Family Housing NCO & Enl	600	2200	70	55	72	68,087	25,104	44,615	93,192	21,833	1,480	728
T 156	FE Facility - Shop	700	1600	55	40	78	10,781	3,537	5,161	11,702	9,003	281	268

Fac No.	Installation Name	Existing Schedule		Heating Season		Cooling	Degree Hours per Year, 7 Days/Wk					FULL LOAD HOURS/YEAR	
	FE Facility - Office	Time HVAC ON	Time HVAC OF	Setpoint Deg F	Setback Deg F	Setpoint Deg F	Heating ON	Heating Set-Back	Htg Setbk 7 Day/Wk	Total Heating	Total Cooling	Heating FLHr/Yr	Cooling FLHr/Yr
T 158	**Vehicle Storage**	Not in Use		Not in Use				Not in Use					
T 161	**Admin General Purpose**	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 162	**Elec Maint. Shop**	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 163	Officers Quarters Military	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 164	Admin General Purpose	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 165	Admin General Purpose	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 166	Officers Quarters Military	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 167	Officers Quarters Military	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 168	**General Purp Warehouse**	700	1600	68	55	72	33,064	33,833	44,615	44,615	15,420	0	0
T 172	**Cold Storage Warehouse**	NA	NA	NA	NA	NA	-	-	-	-	-	-	-
P 177	**Technical Library**	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 178	**Child Development Cntr**	600	1800	72	55	72	56,886	29,446	44,615	74,412	19,953	1,022	475
S 182	**Commissary**	900	1700	68	55	72	18,715	40,610	44,615	55,122	18,106	568	431
S 186	**Sup Svc Admin Bldg**	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 190	**Post Chapel**	600	1900	70	55	72	53,500	29,096	44,615	82,596	21,102	1,163	703
S 197	**Admin Bldg R&D - Office**	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
	Admin Bldg R&D - Electronics	0	2400	68	68	72	115,562	0	0	115,562	21,833	2,626	728
S 198	**General Inst Bldg**	800	1800	68	40	72	27,529	3,537	5,161	19,963	19,953	392	380
P 205 P 205A	Admin General Purpose **Company HQ Building**	600	2200	68	55	72	60,015	25,104	44,615	73,547	21,833	1,137	520
P 206	**Enlisted Pers Dining Fac** **Kitchen Area - Scullery**	0	2400	68	68	72	115,562	0	0	115,562	21,833	2,626	728
P 207 P 207A	**Enl Barracks w/o Dining** **Company HQ Building**	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
P 208 P 208A	**Enl Barracks w/o Dining** Company HQ Building	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
P 209	**AAFES Snack Bar**	600	1600	68	55	72	41,952	29,585	44,615	71,537	15,420	953	514
P 210	**Hlth/Dntl Clinic w/ Beds**	0	2400	68	68	72	115,562	0	0	115,562	21,833	2,626	728
P 211	Outdoor Swimming Pool	NA			NA			NA			NA	NA	
P 212	**Gymnasium**	1000	2100	65	40	72	18,590	5,161	5,161	23,751	21,833	453	728
P 219	Physical Fitness Center	1000	2100	65	40	72	18,590	5,161	5,161	23,751	21,833	453	728
P 229 P 229A	**Enl Barracks w/o Dining** Company HQ Building	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
P 230 P 230A	**Enl Barracks w/o Dining** Company HQ Building	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
S 235	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 236	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 237	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 238	**Sig Photo Lab** **Process**	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 240	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 241	**GM Facility**	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 243	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 244	**Admin General Purpose**	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367

ECO B6/7
Sheet 7 of 15

ECO B6/7
Sheet 8 of 15

Fac No.	Installation Name	Existing Schedule: Time HVAC ON	Existing Schedule: Time HVAC OF	Heating Season: Setpoint Deg F	Heating Season: Setback Deg F	Cooling: Setpoint Deg F	Degree Hours per Year, 7 Days/Wk: Heating ON	Heating Set-Back	Htg Setbk 7 Day/Wk	Total Heating	Total Cooling	FULL LOAD HOURS/YEAR: Heating FLHr/Yr	Cooling FLHr/Yr
S 246	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 247	Admin General Purpose	700	1700	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 252	Vehicle Maint Shop DS	600	1600	65	45	72	34,454	3,537	44,615	39,883	15,420	625	367
P 256	Vehicle Maint Shop ORG	600	1600	65	45	72	34,454	3,537	44,615	39,883	15,420	625	367
P 259	Vehicle Maint Shop ORG	600	1600	65	45	72	34,454	3,537	44,615	39,883	15,420	625	367
S 283	FE Maintenance Shop	700	1700	55	40	72	10,781	4,287	5,161	12,238	15,420	288	367
S 286	Admin General Purpose	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 287	Recreation Building	1200	2100	68	55	72	18,027	41,783	44,615	59,809	20,692	410	690
S 288	General Purpose Warehouse	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 290	Electron Equip Facility	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
S 291	Cont Humid Warehouse	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 295	Enl Barracks w/o Dining	600	2200	68	55	72	60,015	25,104	44,615	85,120	21,833	1,364	728
P 301	ADP Building Office	700	1600	68	55	72	33,064	33,833	44,615	60,531	15,420	756	367
	Computer Room	0	2400	68	68	74	115,562	0	0	115,562	17,007	2,626	607
P 642	Detached Latrine/Shower	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S 2201	Control Tower - Range SPT	15 d/y Jan & Jul		65	OFF	72	5,137	0	0	5,137	1,610	125	54
Totals													

ECO B6/7
Sheet 9 of 15

Fac No.	ECO B6/B7 Energy Savings: Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	ECO B6/B7 Energy Cost Savings: Electric $/Year	Propane $/Year	Fuel Oil $/Year	Total $/Year	Non-Energy Saving: Non-Egy $/Yr	LCC $ Total	Construction Cost: Bare Cost	Constr Cost	Total Cost	PG&E Rebate	Total Invest	Life Cycle Cost Analysis: LCC,N=15 Savings	Simple Payback	SIR
T 6	839	14.7	0.0	$63	$116	$0	$178	($6)	($67)	$137	$214	$238	$45	$193	$2,302	1.12	11.913
P 41A	532	2.7	0.0	$40	$21	$0	$61	($1)	($7)	$274	$427	$477	$90	$387	$753	6.45	1.948
P 41B																	
P 42A	618	3.1	0.0	$46	$24	$0	$70	($1)	($7)	$274	$427	$477	$90	$387	$876	5.54	2.267
P 42B																	
P 43A	618	3.1	0.0	$46	$24	$0	$70	($1)	($7)	$274	$427	$477	$90	$387	$876	5.54	2.267
P 43B																	
P 44A	618	3.1	0.0	$46	$24	$0	$70	($1)	($7)	$274	$427	$477	$90	$387	$876	5.54	2.267
P 44B																	
P 45A	618	3.1	0.0	$46	$24	$0	$70	($1)	($7)	$274	$427	$477	$90	$387	$876	5.54	2.267
P 45B																	
P 46	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 47	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 51A	618	3.1	0.0	$46	$24	$0	$70	($1)	($7)	$274	$427	$477	$90	$387	$876	5.54	2.267
P 51B																	
P 52A	618	3.1	0.0	$46	$24	$0	$70	($1)	($7)	$274	$427	$477	$90	$387	$876	5.54	2.267
P 52B																	
P 53	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 54	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 55	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 56	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 57	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 58	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 59	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
P 60	522	2.9	0.0	$39	$23	$0	$62	($6)	($67)	$137	$214	$238	$45	$193	$715	3.46	3.698
S 79	-	-	-	-	-	-	-										
P 80	9,589	92.5	0.0	$715	$728	$0	$1,442	($1)	($7)	$171	$267	$297	$40	$257	$18,659	0.18	72.489
P 81	-	-	-	-	-	-	-										
P 101	28,041	0.0	0.0	$2,090	$0	$0	$2,090	($194)	($2,159)	$5,463	$8,521	$9,501	$1,280	$8,221	$22,296	4.34	2.712
P 116	276	0.0	0.0	$21	$0	$0	$21	($6)	($67)	$137	$214	$238	$45	$193	$173	13.32	0.896
T 120	-	-	-	-	-	-	-										
T 121	186	6.0	0.0	$14	$47	$0	$61	($1)	($7)	$274	$427	$477	$90	$387	$820	6.42	2.122
T 124	2,215	61.3	0.0	$165	$482	$0	$648	($6)	($67)	$137	$214	$238	$45	$193	$8,696	0.30	44.991
T 127	-	-	-	-	-	-	-										
P 128	22,574	682.9	0.0	$1,683	$5,375	$0	$7,057	($279)	($3,103)	$6,302	$9,830	$10,961	$2,070	$8,891	$92,690	1.31	10.426
T 131	750	12.4	0.0	$56	$98	$0	$153	($6)	($67)	$137	$214	$238	$45	$193	$1,968	1.31	10.185
S 144	Facility not used			-	-	-	-										
S 146	1,022	12.2	0.0	$76	$96	$0	$172	($6)	($67)	$308	$480	$536	$85	$451	$2,183	2.71	4.845
T 149	1,012	36.5	0.0	$75	$287	$0	$363	($6)	($67)	$137	$214	$238	$45	$193	$4,883	0.54	25.263
T 156	ECO B6 Not Applicable			-	-	-	-										

ECO B6/7
Sheet 10 of 15

Fac No.	ECO B6/B7 Energy Savings Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	ECO B6/B7 Energy Cost Savings Electric $/Year	Propane $/Year	Fuel Oil $/Year	Total $/Year	Non-Energy Saving Non-Egy $/Yr	LCC $ Total	Construction Cost Bare Cost	Constr Cost	Total Cost	PG&E Rebate	Total Invest	Life Cycle Cost Analysis LCC,N=15 Savings	Simple Payback	SIR
T 158	-	-	-	-	-	-	-										
T 161	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
T 162	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
T 163	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
T 164	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
T 165	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
T 166	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
T 167	2,006	12.3	0.0	$150	$97	$0	$246	($1)	($7)	$274	$427	$477	$90	$387	$3,113	1.57	8.054
S 168	-	-	-	-	-	-	-										
T 172	-	-	-	-	-	-	-										
P 177	3,526	16.7	0.0	$263	$132	$0	$394	($6)	($67)	$137	$214	$238	$45	$193	$4,871	0.50	25.203
P 178	5,588	22.4	0.0	$417	$176	$0	$593	($6)	($67)	$21	$33	$37	$0	$37	$7,302	0.06	199.929
S 182	2,522	29.4	0.0	$188	$231	$0	$419	($6)	($67)	$137	$214	$238	$45	$193	$5,405	0.47	27.965
S 186	3,197	35.8	0.0	$238	$282	$0	$520	($1)	($7)	$274	$427	$477	$90	$387	$6,771	0.74	17.516
P 190	-	-	-	-	-	-	-										
S 197	Recommend replacement of HVAC Central Plant equip, thus N/A			-	-	-	-										
S 198	0	0.0	0.0	-	-	-	-										
P 205	105	0.0	492.0	$8	$0	$2,450	$2,458	($85)	($944)	$1,918	$2,992	$3,336	$630	$2,706	$32,910	1.14	12.163
P 205A																	
P 206				-	-	-	-										
P 207	105	0.0	492.0	$8	$0	$2,450	$2,458	($85)	($944)	$1,918	$2,992	$3,336	$630	$2,706	$32,910	1.14	12.163
P 207A																	
P 208	105	0.0	492.0	$8	$0	$2,450	$2,458	($85)	($944)	$1,918	$2,992	$3,336	$630	$2,706	$32,910	1.14	12.163
P 208A																	
P 209	11,449	6.9	0.0	$853	$54	$0	$908	($1)	($7)	$274	$427	$477	$90	$387	$10,747	0.43	27.803
P 210	-	-	-	-	-	-	-										
P 211	-	-	-	-	-	-	-										
P 212	1,238	321.0	0.0	$92	$2,526	$0	$2,619	($1)	($7)	$274	$427	$477	$90	$387	$36,845	0.15	95.318
P 219	-	-	-	-	-	-	-										
P 229	105	0.0	492.0	$8	$0	$2,450	$2,458	($85)	($944)	$1,918	$2,992	$3,336	$630	$2,706	$32,910	1.14	12.163
P 229A																	
P 230	105	0.0	492.0	$8	$0	$2,450	$2,458	($85)	($944)	$1,918	$2,992	$3,336	$630	$2,706	$32,910	1.14	12.163
P 230A																	
S 235	-	-	-	-	-	-	-										
S 236	-	-	-	-	-	-	-										
S 237	-	-	-	-	-	-	-										
S 238	-	-	-	-	-	-	-										
	-	-	-														
P 240	-	-	-	-	-	-	-										
S 241	-	-	-	-	-	-	-										
	-	-	-														
	-	-	-														
S 243	-	-	-	-	-	-	-										
S 244	-	-	-	-	-	-	-										

ECO B6/7
Sheet 11 of 15

Fac	ECO B6/B7 Energy Savings			ECO B6/B7 Energy Cost Savings				Non-Energy Saving		Construction Cost					Life Cycle Cost Analysis		
No.	Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Year	Propane $/Year	Fuel Oil $/Year	Total $/Year	Non-Egy $/Yr	LCC $ Total	Bare Cost	Constr Cost	Total Cost	PG&E Rebate	Total Invest	LCC,N=15 Savings	Simple Payback	SIR
S 246	-	-	-	-	-	-	-										
S 247	-	-	-	-	-	-	-										
P 252	Already has T-Stats on Clocks			-	-	-	-										
P 256	Already has T-Stats on Clocks			-	-	-	-										
P 259	Already has T-Stats on Clocks			-	-	-	-										
S 283	57	23.0	0.0	$4	$181	$0	$185	($6)	($67)	$137	$214	$238	$45	$193	$2,545	1.08	13.170
S 286	-	-	-	-	-	-	-										
P 287	Already has T-Stats on Clocks			-	-	-	-										
S 288	-	-	-	-	-	-	-										
S 290	9,292	305.4	0.0	$693	$2,403	$0	$3,096	($24)	($270)	$548	$855	$953	$180	$773	$41,864	0.25	54.151
S 291	5,142	105.7	0.0	$383	$832	$0	$1,215	($1)	($7)	$274	$427	$477	$90	$387	$16,261	0.32	42.067
P 295	74,049	1,159.5	0.0	$5,520	$9,125	$0	$14,645	($728)	($8,095)	$16,440	$25,644	$28,593	$5,400	$23,193	$185,695	1.67	8.007
P 301	9,212	317.9	0.0	$687	$2,502	$0	$3,188	($1)	($7)	$274	$427	$477	$90	$387	$43,451	0.12	112.407
P 642	-	-	-	-	-	-	-										
S 2201	-	-	-	-	-	-	-										
Totals	215,801	3,399	2,460	$16,065	$26,748	$12,251	$55,064	($1,778)	($19,773)	$46,652	$72,770	$81,138	$14,770	$66,368	$715,759	1.25	10.785

Note: Above totalts do not include building 116 results which have an SIR < 1.0.

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993	SHEET 12	OF 15

Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-B6/7 (T-Clock / Programmable Tstat)	Estimator: RJB	Checked By: BIH

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 6							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 6)							$137
Building 41, 42, 43, 44, 45, 51 & 52, each							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldgs 41, 42, 43, 44, 45, 51 & 52, each)							$274
Buildings 46, 47, 53, 54, 55, 56, 57, 58, 59 & 60, each							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldgs 46, 47, 53, 54, 55, 56, 57, 58, 59 & 60, each)							$137
Building 101 Dining & Lounge Areas and Dwelling Units							
Time Clock & Wiring - Din/Lng	2	EA	$51	$102	$120	$239	$341
Time Clock & Wiring - Dwellings	30	EA	$51	$1,534	$120	$3,587	$5,121
Subtotal (Bldg 101 Dining & Lounge Areas and Dwelling Units)							$5,463
Building 116							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 116)							$137
Building 121							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldg 121)							$274
Building 124							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 124)							$137
Building 128							
24 Hour Auto T-Stat	46	EA	$32	$1,472	$105	$4,830	$6,302
Subtotal (Bldg 128)							$6,302
Building 131							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 131)							$137
Building 146							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Time Clock & Wiring	1	EA	$51	$51	$120	$120	$171
Subtotal (Bldg 146)							$308
Subtotal, this Sheet, including all buildings							$16,182

CONSTRUCTION COST ESTIMATE				Date Prepared: February 1993		SHEET 13 OF 15	
Project: EEAP Limited Energy Study				Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)		
Location: Fort Hunter-Liggett, California							
Engineer-Architect: Keller & Gannon							
Drawing No.: ECO-B6/7 (T-Clock / Programmable Tstat)		Estimator: RJB			Checked By: BIH		

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 149							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 149)							$137
Buildings 161, 162, 163, 164, 165, 166 & 167, each							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldgs 161, 162, 163, 164, 165, 166 & 167, each)							$274
Building 177							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 177)							$137
Building 178							
Reset Existing Timer	1	EA	$16	$16	$5	$5	$21
Subtotal (Bldg 178)							$21
Building 182							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 182)							$137
Building 186							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldg 186)							$274
Buildings 205, 207, 208, 229 & 230, each							
24 Hour Auto T-Stat	14	EA	$32	$448	$105	$1,470	$1,918
Subtotal (Bldgs 205, 207, 208, 229 & 230, each)							$1,918
Building 209							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldg 209)							$274
Building 212							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldg 212)							$274
Building 283							
24 Hour Auto T-Stat	1	EA	$32	$32	$105	$105	$137
Subtotal (Bldg 283)							$137
Subtotal, this Sheet, including all buildings							$12,899

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993	SHEET 14	OF 15

Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO-B6/7 (T-Clock / Programmable Tstat)	Estimator: RJB	Checked By: BIH	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 290							
24 Hour Auto T-Stat	4	EA	$32	$128	$105	$420	$548
Subtotal (Bldg 290)							$548
Building 291							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldg 291)							$274
Building 80							
Time Clock & Wiring	1	EA	$51	$51	$120	$120	$171
Subtotal (Bldg 80)							$171
Building 295							
24 Hour Auto T-Stat	120	EA	$32	$3,840	$105	$12,600	$16,440
Subtotal (Bldg 295)							$16,440
Building 301							
24 Hour Auto T-Stat	2	EA	$32	$64	$105	$210	$274
Subtotal (Bldg 301)							$274
Subtotal, this sheet							$17,707
Subtotal (ECO B-6/7)							$46,788
Sales Tax 8%							$3,743
Subtotal							$50,531
Contractor O.H. & P. 30%							$15,159
Subtotal							$65,690
Bond 1%							$657
Subtotal							$66,347
Estimating Contingency 10%							$6,635
Total Probable Construction Cost							$72,982

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B6/7
Sheet 15 of 15

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: Install Time Clocks/Programmable T-Stats — Fiscal Year FY96
Discrete Portion Name: ECO#B-6/7
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$72,770		
B. SIOH	$4,002		
C. Design Cost	$4,366		
D. Total Cost (1A+1B+1C)	$81,139		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($14,770)	
G. Total Investment (1D-1E-1F)			$66,369

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	735.5		$16,061	11.70	$187,917
B. Dist	$4.98	2,460.0		$12,251	13.78	$168,816
C. Propane	$7.87	3,399.0		$26,750	14.16	$378,782
D. Demand	$108.60		kW	$0	11.70	$0
E. Other						
F. Total				$55,062		$735,515

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($1,778)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($19,771)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) ($19,771)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 1.2 Years
5. Total Net Discounted Savings (2F5+3C): $715,743
6. Savings to Investment Ratio (SIR) 5/1G: 10.78
7. Adjusted Internal Rate of Return (AIRR): 80.27%

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY J CASE CHECKED BY DATE MARCH 1993 REV. 19	ECO B-8 REPLACE INEFFICIENT CHILLER	PROJECT 16-403-10 FHL - EEAP SHEET NO. 1 OF 41 SHEETS

DESCRIPTION OF ACTION

REMOVE EXISTING COMPRESSOR/CONDENSOR ASSEMBLIES AND REPLACE WITH HIGHER EFFICIENCY UNITS OF SIMILAR TYPE CONVERSION TO WATER COOLED UNITS IS PRECLUDED DUE TO WATER SHORTAGE ON BASE

FACILITIES INCLUDED

REFER TO ATTACHED SPREADSHEET PRINTOUTS

ENERGY SAVING CALCULATIONS

THE ELECTRICAL USAGE OF THE EXISTING UNITS HAS BEEN SIMULATED BY TRACE 600 COMPUTER RUNS. THE EER'S AND C.O.P'S OF THESE UNITS HAVE BEEN OBTAINED FROM MANUFACTURES LITERATURE OR FROM TELEPHONE CONVERSATION WITH MANUF REPS. THE EER'S AND COP'S OF THE NEW UNITS ARE BASED ON THE PUBLISHED COP'S OF NEW, READILY AVAILABLE EQUIPMENT. THE ENERGY SAVINGS ARE BASED ON THE DIFFERENCE BETWEEN THE OLD AND NEW EER'S. THE NEW HIGHER EER'S ALSO SAVING ON KW DEMAND.

FORM 101-1/8

ECO B8 - Replace Cooling Equipment with More Efficient Systems - Fort Hunter Liggett, California

REVISED JUNE 93 SHEET 2 OF 41

Fac No.	Installation Name	Unit Nominal Tonnage	Existing Clng Usage (KWH/YR)	Existing Unit EER	New Unit EER	New Clng Usage (KWH/YR)	Savings (KWH/YR)	Demand Savings (KW)
S 197	Admin Bldg R&D - Office (1)	35	12,691	8.5	9.7	11,121	1,570	6.1
P 209	AAFES Snack Bar	18	24,297	7.5	9.7	18,786	5,511	6.5
		7.5	10,123	7.5	9.3	8,164	1,959	2.3
S 238	Sig Photo Lab	30	22,606	7.5	9.3	18,231	4,375	9.3
P 295	Enl Barracks w/o Dining	54	93,825	8.5	9.8	81,379	12,446	10.1
P 241	Electron Maint Shop	20	18,751	8.5	9.7	16,431	2,320	3.5
P 128	Officers Quarters Military	25	37,747	7.5	9.7	29,186	8,561	9.1
P 206	Enlisted Pers Dining Fac	40	49,146	7.5	9.7	37,999	11,147	14.5
P 101	Open Din Cons (Hacienda)	20	3,549	7.5	9.7	2,744	805	7.3
P 210	Hlth/Dntl Clinic w/ Beds	25	28,404	8.0	9.3	24,434	3,970	5.2
S 290	Electron Equip Facility	25	4,843	7.5	9.3	3,906	937	7.7
P 205	Admin General Purpose	80	75,112	8.5	10.6	60,231	14,881	22.4
P 208	Enl Barracks w/o Dining	80	79,250	8.5	10.6	63,550	15,700	22.4
P 207	Enl Barracks w/o Dining	80	75,112	8.5	10.6	60,231	14,881	22.4
P 230	Enl Barracks w/o Dining	80	79,250	8.5	10.6	63,550	15,700	22.4
P 229	Enl Barracks w/o Dining	80	79,250	8.5	10.6	63,550	15,700	22.4
P 81	Theater with Dressing Rm's	120	6,900	9.1	11.3	5,557	1,343	0.0
		40	2,300	8.5	11.4	1,715	585	0.0
P 301	ADP Building	60	18,832	8.5	10.8	14,821	4,011	18.0
	TOTALS (SIR's > 1.0)		546,770			443,147	103,623	164

Fac No.	Annual Cost Savings ($)	Life Cycle Cost Savings ($)	Capitol Costs ($)	PG&E Rebate	Total Invest $	Single Year Savings (2) Savings $	Year Saving Occurs	LCC Savings $	Savings Investment Ratio (SIR)
S 197	$781	$9,136	$59,820	$1,680	$65,019	$53,838	NA	NA	0.14
P 209	$1,120	$13,106	$36,984	$1,584	$39,113	$33,286	10	$22,301	0.91
	$398	$4,660		$540					
S 238	$1,335	$15,620	$45,859	$2,160	$48,973	$41,273	10	$27,653	0.88
P 295	$2,026	$23,704	$72,689	$2,808	$78,240	$65,420	3	$58,224	1.05
P 241	$552	$6,461	$32,499	$960	$35,276	$29,249	5	$23,984	0.86
P 128	$1,623	$18,994	$24,544	$2,200	$25,167	$22,090	5	$18,113	1.47
P 206	$2,407	$28,165	$119,640	$3,520	$129,879	$107,676	5	$88,294	0.90
P 101	$848	$9,924	$22,852	$1,760	$23,720	$20,567	3	$18,304	1.19
P 210	$865	$10,123	$73,352	$1,300	$80,487	$66,017	10	$44,231	0.68
S 290	$911	$10,655	$24,451	$1,800	$25,463	$22,006	3	$19,585	1.19
P 205	$3,539	$41,408	$44,261	$1,120	$48,231	$39,835	5	$32,665	1.54
P 208	$3,600	$42,123	$44,261	$1,120	$48,231	$39,835	5	$32,665	1.55
P 207	$3,539	$41,408	$44,261	$1,120	$48,231	$39,835	5	$32,665	1.54
P 230	$3,600	$42,123	$44,261	$1,120	$48,231	$39,835	5	$32,665	1.55
P 229	$3,600	$42,123	$44,261	$1,120	$48,231	$39,835	5	$32,665	1.55
P 81	$100	$1,172	$91,641	$3,360	$94,180	$82,477	10	$55,260	0.60
	$44	$510		$4,640					
P 301	$2,258	$26,419	$34,317	$5,520	$32,743	$30,885	10	$20,693	1.44
	$25,545	$298,880	$400,158	$19,688	$426,488	$360,142	-	$298,243	1.40

NOTES:

1. Building 197 is scheduled for a complete renovation , including HVAC system. ECO Project for this building is withdrawn
2. Single year (Non-recurring, non-energy) cost savings represent the avoided cost of replacing units at the ends of their useful lifetimes. Remaining lifetimes, shown by "year of savings" are DEH maintenance worker opinions based on years of experience maintaining the equipment.

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CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 3 Of 41

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 197

Estimator:

Checked By:

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing unit	1	EA	-	$1,000	-	$0	$1,000
Provide & Install Packaged 35 ton unit	1	EA		$5,250		$32,100	$37,350
Subtotal							$38,350
Sales Tax @ 8%							$3,068
Subtotal							$41,418
Contractor OH & Profit @ 30%							$12,425
Subtotal							$53,843
Bond @ 1%							$538
Subtotal							$54,382
Estimating Contingency @ 10%							$5,438
Total Probable Construction Cost							$59,820

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet	4
Of	41
Project	EEAP Limited Energy Study
Project No.	
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO B-8 CHILLER REPLCMT BLDG 209
Estimator	
Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	2	EA	$810	$1,620	-	$0	$1,620
Provide & Install Packaged 18 ton unit	1	EA	-	$2,200	-	$12,700	$14,900
Provide & Install Packaged 7.5 ton unit	1	EA	-	$990	-	$6,200	$7,190
Subtotal							$23,710
Sales Tax @ 8%							$1,897
Subtotal							$25,607
Contractor OH & Profit @ 30%							$7,682
Subtotal							$33,289
Bond @ 1%							$333
Subtotal							$33,622
Estimating Contingency @ 10%							$3,362
Total Probable Construction Cost							$36,984

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 5 Of 41

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 238

Estimator:

Checked By:

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	1	EA	-	$1,000	-	$0	$1,000
Provide & Install Packaged 30 ton unit	1	EA	-	$3,800	-	$24,600	$28,400
Subtotal							$29,400
Sales Tax @ 8%							$2,352
Subtotal							$31,752
Contractor OH & Profit @ 30%							$9,526
Subtotal							$41,278
Bond @ 1%							$413
Subtotal							$41,690
Estimating Contingency @ 10%							$4,169
Total Probable Construction Cost							$45,859

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet	6
Of	41
Project	EEAP Limited Energy Study
Project No.	
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO B-8 CHILLER REPLCMT BLDG 295
Estimator	
Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	1	EA	-	$1,250	-	$0	$1,250
Provide & Install Packaged 50 ton unit	1	EA	-	$6,450	-	$38,900	$45,350
Subtotal							$46,600
Sales Tax @ 8%							$3,728
Subtotal							$50,328
Contractor OH & Profit @ 30%							$15,098
Subtotal							$65,426
Bond @ 1%							$654
Subtotal							$66,081
Estimating Contingency @ 10%							$6,608
Total Probable Construction Cost							$72,689

CONSTRUCTION COST ESTIMATE					Date Prepared February 1993		Sheet 7	Of 41
Project EEAP Limited Energy Study					Project No.	Basis for Estimate Code A (no design competed)		
Location Fort Hunter-Liggett, California								
Engineer-Architect Keller & Gannon								
Drawing No. ECO B-8 CHILLER REPLCMT BLDG 241		Estimator				Checked By		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing unit	1	EA	-	$810	-	$0	$810
Provide & Install Packaged 20 ton unit	1	EA	-	$2,625	-	$17,400	$20,025
Subtotal							$20,835
Sales Tax @ 8%							$1,667
Subtotal							$22,502
Contractor OH & Profit @ 30%							$6,751
Subtotal							$29,252
Bond @ 1%							$293
Subtotal							$29,545
Estimating Contingency @ 10%							$2,954
Total Probable Construction Cost							$32,499

CONSTRUCTION COST ESTIMATE							Date Prepared: February 1993	Sheet 8 Of 41
Project: EEAP Limited Energy Study					Project No.		Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California								
Engineer-Architect: Keller & Gannon								
Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 128		Estimator					Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	1	EA	-	$810	-	$0	$810
Provide & Install 25 ton Air Cooled	1	EA	-	$2,625	-	$12,300	$14,925
DX unit							
Subtotal							$15,735
Sales Tax @ 8%							$1,259
Subtotal							$16,994
Contractor OH & Profit @ 30%							$5,098
Subtotal							$22,092
Bond @ 1%							$221
Subtotal							$22,313
Estimating Contingency @ 10%							$2,231
Total Probable Construction Cost							$24,544

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 9 Of 41

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 206

Estimator:

Checked By:

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing unit	2	EA	$1,000	$2,000	-	$0	$2,000
Provide & Install Packaged 40 ton unit	2	EA	$5,250	$10,500	$32,100	$64,200	$74,700
Subtotal							$76,700
Sales Tax @ 8%							$6,136
Subtotal							$82,836
Contractor OH & Profit @ 30%							$24,851
Subtotal							$107,687
Bond @ 1%							$1,077
Subtotal							$108,764
Estimating Contingency @ 10%							$10,876
Total Probable Construction Cost							$119,640

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 10 Of 41

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 101

Estimator:

Checked By:

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	1	EA	$750	$750	-	$0	$750
Provide & Install 20 ton Air Cooled	1	EA	$2,400	$2,400	$11,500	$11,500	$13,900
DX unit							
Subtotal							$14,650
Sales Tax @ 8%							$1,172
Subtotal							$15,822
Contractor OH & Profit @ 30%							$4,747
Subtotal							$20,569
Bond @ 1%							$206
Subtotal							$20,774
Estimating Contingency @ 10%							$2,077
Total Probable Construction Cost							$22,852

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 210

Estimator:

Checked By:

Line Item	Quantity: No. Units	Quantity: Unit Meas.	Labor: Per Unit	Labor: Total	Material: Per Unit	Material: Total	Total Cost
Demolish existing unit	3	EA	$750	$2,250	-	$0	$2,250
Provide & Install 25 ton Air Cooled DX unit	3	EA	$2,625	$7,875	$12,300	$36,900	$44,775
Subtotal							$47,025
Sales Tax @ 8%							$3,762
Subtotal							$50,787
Contractor OH & Profit @ 30%							$15,236
Subtotal							$66,023
Bond @ 1%							$660
Subtotal							$66,683
Estimating Contingency @ 10%							$6,668
Total Probable Construction Cost							$73,352

CONSTRUCTION COST ESTIMATE					Date Prepared February 1993		Sheet 12 Of 41
Project: EEAP Limited Energy Study					Project No.	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California							
Engineer-Architect: Keller & Gannon							
Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 290			Estimator			Checked By	

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing unit	1	EA	$750	$750	-	$0	$750
Provide & Install 25 ton Air Cooled DX unit	1	EA	$2,625	$2,625	$12,300	$12,300	$14,925
Subtotal							$15,675
Sales Tax @ 8%							$1,254
Subtotal							$16,929
Contractor OH & Profit @ 30%							$5,079
Subtotal							$22,008
Bond @ 1%							$220
Subtotal							$22,228
Estimating Contingency @ 10%							$2,223
Total Probable Construction Cost							$24,451

CONSTRUCTION COST ESTIMATE		Date Prepared: February 1993	Sheet 13 Of 41
Project: EEAP Limited Energy Study		Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 205	Estimator		Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	1	EA	$750	$750	-	$0	$750
Provide & Install 80 ton Air Cooled	1	EA	$2,625	$2,625	$25,000	$25,000	$27,625
DX unit							
Note: This cost estimate is the same							
for BLDG'S 208, 207, 230, 229							
Subtotal							$28,375
Sales Tax @ 8%							$2,270
Subtotal							$30,645
Contractor OH & Profit @ 30%							$9,194
Subtotal							$39,839
Bond @ 1%							$398
Subtotal							$40,237
Estimating Contingency @ 10%							$4,024
Total Probable Construction Cost							$44,261

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 14 Of 41
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO B-8 CHILLER REPLCMT BLDG 81	Estimator	Checked By

Line Item	Quantity		Labor		Material		Total - Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	2	EA	$1,000	$2,000	-	$0	$2,000
Provide & Install 120 ton Air Cooled DX unit	1	EA	$3,250	$3,250	$37,500	$37,500	$40,750
Provide & Install 40 ton Air Cooled DX unit	1	EA	$2,400	$2,400	$13,600	$13,600	$16,000
Subtotal							$58,750
Sales Tax @ 8%							$4,700
Subtotal							$63,450
Contractor OH & Profit @ 30%							$19,035
Subtotal							$82,485
Bond @ 1%							$825
Subtotal							$83,310
Estimating Contingency @ 10%							$8,331
Total Probable Construction Cost							$91,641

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet 15 Of 41	
Project	EEAP Limited Energy Study
Project No.	
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO B-8 CHILLER REPLCMT BLDG 301
Estimator	
Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing unit	1	EA	$1,000	$1,000	-	$0	$1,000
Provide & Install 60 ton Air Cooled DX unit	1	EA	$2,100	$2,100	$18,900	$18,900	$21,000
Subtotal							$22,000
Sales Tax @ 8%							$1,760
Subtotal							$23,760
Contractor OH & Profit @ 30%							$7,128
Subtotal							$30,888
Bond @ 1%							$309
Subtotal							$31,197
Estimating Contingency @ 10%							$3,120
Total Probable Construction Cost							$34,317

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California
Project Title: Chiller Replacement
Discrete Portion Name: ECO# B-8
Analysis Date: June 1993

Region No. 4

Economic Life: 15 YEARS

Project No. 16-403-10
Fiscal Year FY96

Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$400,158		
B. SIOH	$22,009		
C. Design Cost	$24,009		
D. Total Cost (1A+1B+1C)	$446,176		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$19,688	
G. Total Investment (1D-1E-1F)			$426,488

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	353.7	$7,724	11.70	$90,371
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	164.1 kW	$17,821	11.70	$208,508
E. Other					
F. Total			$25,545		$298,880

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.	$107,993	3	0.89	$96,114
b.	$221,264	5	0.82	$181,437
c.	$30,885	10	0.67	$20,693
d. Total	$360,142			$298,243

C Total Non Energy Discounted Savings (3A2+3Bd4) $298,243

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 8.6 Years
5. Total Net Discounted Savings (2F5+3C): $597,123
6. Savings to Investment Ratio (SIR) 5/1G: 1.40
7. Adjusted Internal Rate of Return (AIRR): 9.92 %

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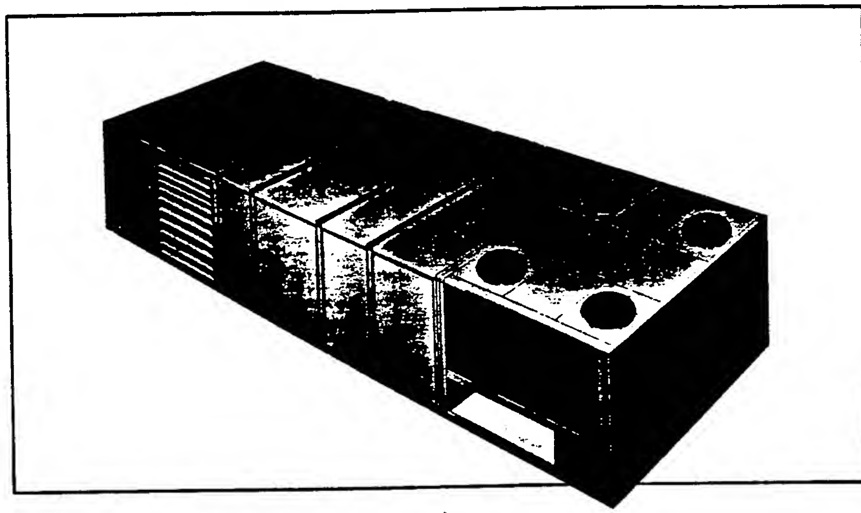
ECO B-8



BLDG 238, 31 TON UNIT

Roofpak Single Zone Heating & Cooling Units

Type RPS
Sizes 18–120 tons

McQuay
Air Conditioning

Physical data

TABLE 1

RPS Unit Size	018B	020B	025B	030B	036B
Nominal Capacity (tons)*	17.7	20.4	25.6	30.1	34.8
Nominal CFM	7,000	8,000	10,000	12,000	14,000
Compressor					
Type	Accessible Semi-Hermetic				
Number—HP	1-20	1-25	1-30	1-35	1-40
Number of Cylinders	4	4	6	6	6
Capacity Control (Std.)	100/50/0	100/50/0	100/66/0	100/66/0	100/66/0
Optional Capacity Control (1)	—	—	100/66/33/0	100/66/33/0	100/66/33/0
Evaporator Section					
Number of Rows Std. (Opt.)	2(3, 4, 5)	2(3, 4, 5)	2(3, 4, 5)	2(3, 4, 5)	3(4, 5)
Face Area (sq. ft.)	18.8	18.8	27.3	27.3	27.3
Supply Air Fans					
Type	Low-Pressure, Forward Curved				
Number—Diameter (in.)	2-15	2-15	2-15	2-15	1-24
CFM Range	4,000-12,000	5,600-12,000	5,600-16,000	5,600-16,000	11,200-17,700
Type	Medium Pressure, Forward Curved				
Number—Diameter (in.)	—	—	—	—	1-24
CFM Range	—	—	—	—	11,200-17,700
Type	Low-Medium Pressure, Airfoil or Backward Curve				
Number—Diameter (in.)	—	—	—	—	1-24
CFM Range	—	—	—	—	11,200-17,700
Condenser Coil					
Circuits/Rows	1/2	1/2	1/3	1/3	1/2
Face Area (sq. ft.)	42.2	42.2	42.2	42.2	62.5
Condenser Fan					
Type	Propeller				
Number—Diameter (in.)	2-26	2-26	3-26	3-26	4-26
CFM Std.	17,040	17,040	23,700	23,700	32,720
Condenser Fan Motor					
Number—HP	2-1.5	2-1.5	3-1.5	3-1.5	4-1.5
Speed (RPM)	1140	1140	1140	1140	1140
Drive	Direct Drive				
Water Heating Coils					
Type	Low Capacity Coil—1/2" O.D.				
Fins/Rows	12/1	12/1	12/1	12/1	12/1
Face Area (sq. ft.)	20.3	20.3	20.3	20.3	20.3
Type	High Capacity Coil—1/2" O.D.				
Fins/Rows	12/2	12/2	12/2	12/2	12/2
Face Area (sq. ft.)	20.3	20.3	20.3	20.3	20.3
Steam Heating Coils					
Type	Low Capacity Coil—1" O.D., Jet Distributing Type				
Fins/Rows	6/1	6/1	6/1	6/1	6/1
Face Area (sq. ft.)	20.3	20.3	20.3	20.3	20.3
Type	High Capacity Coil—1" O.D., Jet Distributing Type				
Fins/Rows	12/1	12/1	12/1	12/1	12/1
Face Area (sq. ft.)	20.3	20.3	20.3	20.3	20.3
Natural Gas or Oil Furnace					
Input (MBH)	** 250; 312; 400; 500; 625; 800; 812; 988; 1000; 1250				
Output (MBH) Furnace Size	** 200; 250; 320; 400; 500; 640; 650; 790; 800; 1000				
Filters (Std.)					
Area (sq. ft.)	52.7	52.7	52.7	52.7	52.7
Number—Size (in.)	15-16 x 25 x 2, 5-16 x 20 x 2				
Optional Filters					
Type	45% Bag Filters				
Number—Size (in.)	4-24 x 24 x 22, 4-12 x 24 x 22				
Type	95% Bag Filters				
Number—Size (in.)	4-24 x 24 x 35, 4-12 x 24 x 35				
Type	Pre-Filters (For Bag Filters)				
Number—Size (in.)	4-24 x 24 x 2, 4-12 x 24 x 2				
Optional Return Air Fans					
Type	Low Pressure Forward Curved				
Number—Diameter (in.)	2-15	2-15	2-15	2-15	Select Airfoil
Standard CFM	5,600	6,400	8,000	9,600	
Type	Low-Medium Pressure Airfoil				
Number—Diameter (in.)	—	—	—	—	1—40 x 14
Standard CFM	—	—	—	—	11,200
Connections					
Discharge Duct	14 x 78	14 x 78	14 x 78	14 x 78	18 x 78
Bottom Return Duct	20 x 82	20 x 82	20 x 82	20 x 82	***
Back Return	15 5/8 x 90	15 5/8 x 90	15 5/8 x 90	15 5/8 x 90	****

*Based on 80F dbt, 67F wbt entering air with 95F air across condenser.

**Furnace size availability is limited by minimum CFM requirement per table 21A on page 81.

***Without return fan: 24 x 82"; with return fan: 36 x 78".

****Not available on units with return fan. Back return dimensions without return fan is 15 5/8 x 90".

Unit size 030B

UNIT DATA	ENT. AIR TEMP. DB	WB	85 TH	85 SH	85 KW	95 TH	95 SH	95 KW	105 TH	105 SH	105 KW	115 TH	115 SH	115 KW
RPS-030B 10,000 CFM 2-ROW EVAP. STD. COIL	75	71	397	167	33.2	378	160	35.8	358	152	38.5	***	***	****
		67	371	208	32.0	353	201	34.4	334	193	37.0	314	185	39.7
		63	***	***	****	329	242	33.1	312	234	35.6	292	226	38.2
	80	71	396	215	33.2	377	208	35.8	357	200	38.5	***	***	****
		67	370	256	31.9	352	249	34.4	333	241	37.0	313	233	39.6
		63	***	***	****	329	289	33.1	311	281	35.6	293	272	38.2
	85	71	396	263	33.2	377	256	35.8	357	248	38.4	***	***	****
		67	370	304	31.9	351	297	34.4	333	289	37.0	314	281	39.7
		63	***	***	****	332	327	33.3	317	317	36.0	302	302	38.8
	90	71	395	311	33.1	376	304	35.7	356	296	38.4	***	***	****
		67	371	349	32.0	354	340	34.5	336	328	37.2	319	319	40.1
		63	362	362	31.5	348	348	34.2	334	334	37.0	318	318	40.0
RPS-030B 12,000 CFM 2-ROW EVAP. STD. COIL	75	71	408	174	33.7	387	167	36.3	366	159	39.0	***	***	****
		67	381	222	32.4	362	215	34.9	342	207	37.5	321	199	40.2
		63	356	270	31.2	337	262	33.6	319	254	36.1	300	246	38.7
	80	71	407	230	33.7	387	223	36.3	366	216	39.0	***	***	****
		67	381	278	32.4	361	271	34.9	341	263	37.5	321	255	40.2
		63	356	325	31.2	339	316	33.7	321	307	36.2	302	296	38.9
	85	71	407	287	33.7	386	279	36.2	365	272	38.9	***	***	****
		67	380	334	32.4	362	326	35.0	342	317	37.6	323	307	40.3
		63	364	364	31.6	350	350	34.3	334	334	37.0	318	318	40.0
	90	71	406	343	33.6	387	335	36.3	366	327	39.0	***	***	****
		67	385	378	32.7	369	369	35.3	353	353	38.2	***	***	****
		63	384	384	32.6	369	369	35.3	353	353	38.2	***	***	****
RPS-030B 14,000 CFM 2-ROW EVAP. STD. COIL	75	71	416	181	34.1	395	174	36.7	373	166	39.4	***	***	****
		67	388	235	32.8	369	228	35.3	348	220	37.9	327	212	40.6
		63	363	289	31.6	344	281	34.0	325	274	36.5	305	265	39.1
	80	71	415	245	34.0	394	238	36.7	372	230	39.3	***	***	****
		67	388	299	32.8	368	292	35.3	348	284	37.9	327	276	40.5
		63	365	349	31.7	348	339	34.2	330	326	36.8	312	312	39.6
	85	71	414	309	34.0	394	302	36.6	372	294	39.3	***	***	****
		67	389	361	32.9	371	352	35.4	351	341	38.1	***	***	****
		63	380	380	32.4	365	365	35.1	348	348	37.9	***	***	****
	90	71	416	372	34.1	395	363	36.7	375	354	39.5	***	***	****
		67	401	401	33.4	385	385	36.2	368	368	39.1	***	***	****
		63	401	401	33.4	385	385	36.2	368	368	39.1	***	***	****
RPS-030B 10,000 CFM 3-ROW EVAP.	75	71	410	172	33.8	390	164	36.4	369	156	39.1	***	***	****
		67	382	212	32.5	363	204	35.0	344	196	37.6	323	188	40.3
		63	356	252	31.2	339	245	33.7	320	236	36.2	301	228	38.8
	80	71	410	219	33.8	390	211	36.4	369	204	39.1	***	***	****
		67	382	260	32.5	363	252	35.0	343	244	37.6	323	236	40.3
		63	356	300	31.2	338	292	33.7	320	284	36.2	301	275	38.8
	85	71	409	267	33.8	389	259	36.4	368	251	39.1	***	***	****
		67	381	307	32.4	363	299	35.0	343	291	37.6	323	283	40.3
		63	358	345	31.3	341	335	33.8	325	325	36.5	308	308	39.3
	90	71	409	314	33.8	389	306	36.4	368	298	39.1	***	***	****
		67	382	354	32.5	364	345	35.1	346	335	37.8	***	***	****
		63	371	371	32.0	356	356	34.7	341	341	37.5	325	325	40.5
RPS-030B 12,000 CFM 3-ROW EVAP.	75	71	422	179	34.4	401	171	37.0	379	163	39.7	***	***	****
		67	393	226	33.0	374	218	35.6	353	210	38.2	***	***	****
		63	367	273	31.8	349	265	34.2	329	257	36.7	309	248	39.3
	80	71	422	234	34.3	400	227	37.0	378	219	39.7	***	***	****
		67	393	282	33.0	373	274	35.6	352	266	38.2	***	***	****
		63	367	328	31.8	349	320	34.3	330	311	36.8	310	300	39.5
	85	71	421	290	34.3	400	282	37.0	378	274	39.7	***	***	****
		67	393	337	33.0	374	329	35.6	353	321	38.2	***	***	****
		63	374	374	32.1	358	358	34.7	342	342	37.5	325	325	40.5
	90	71	421	346	34.3	400	338	36.9	378	330	39.7	***	***	****
		67	397	387	33.2	379	379	35.9	361	361	38.7	***	***	****
		63	393	393	33.0	378	378	35.8	361	361	38.7	***	***	****
RPS-030B 14,000 CFM 3-ROW EVAP.	75	71	431	186	34.8	409	178	37.4	386	170	40.1	***	***	****
		67	402	239	33.5	382	231	36.0	360	223	38.6	***	***	****
		63	375	292	32.2	356	284	34.6	336	276	37.1	315	267	39.8
	80	71	431	249	34.8	409	241	37.4	385	233	40.1	***	***	****
		67	402	303	33.4	381	295	36.0	360	286	38.6	***	***	****
		63	376	354	32.3	358	344	34.7	339	332	37.4	320	320	40.1
	85	71	430	312	34.7	409	305	37.4	385	296	40.1	***	***	****
		67	403	365	33.5	382	356	36.0	362	346	38.7	***	***	****
		63	391	391	32.9	374	374	35.6	357	357	38.5	***	***	****
	90	71	431	375	34.7	409	367	37.4	386	358	40.2	***	***	****
		67	412	412	33.9	395	395	36.7	378	378	39.6	***	***	****
		63	412	412	33.9	395	395	36.7	378	378	39.6	***	***	****

8

TRANE

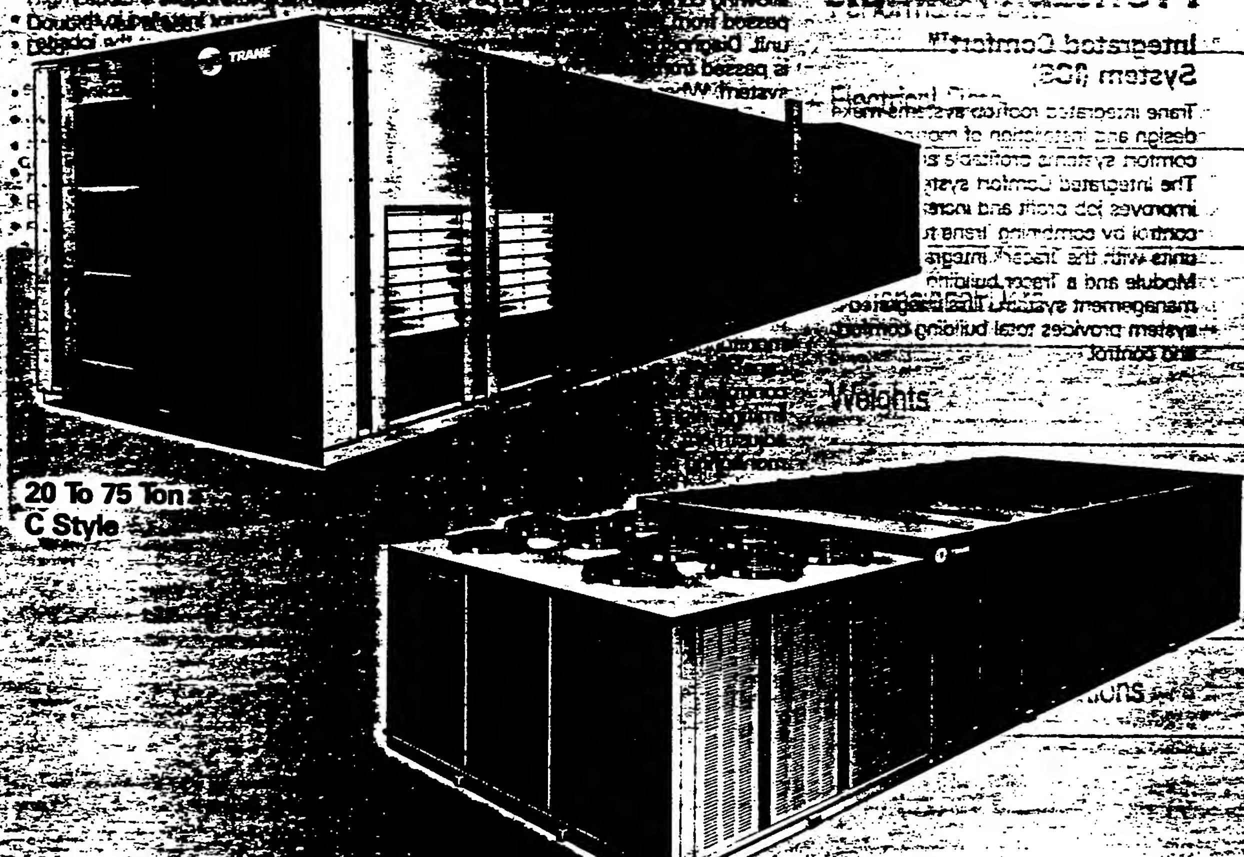
20 OF 41
ECO B-8

RT-DS-1
November 1992
First Printing

BLDG 206

Packaged Rooftop Air Conditioners

20 To 130-Tons C and E Style



20 To 75 Ton C Style

90 To 130 Ton E Style

TRANE

Model Number Description

S	F	H	C	C25	4	H	C	0	0	B	3	9	A	1	A	1	0	L
1	2	3	4	567	8	9	10	11	12	13	14	15	16	17	18	19	20	21

DIGIT 1 — UNIT TYPE
S = Self-Contained (Packaged Rooftop)

DIGIT 2 — UNIT FUNCTION
A = DX Cooling, No Heat
E = DX Cooling, Electric Heat**
F = DX Cooling, Natural Gas Heat
L = DX Cooling, Hot Water Heat*
S = DX Cooling, Steam Heat*
X = DX Cooling, No Heat, Extended Casing
*(See Note 2)
**(See Note 3)

DIGIT 3 — UNIT AIRFLOW
H = Single Zone

DIGIT 4 — DEVELOPMENT SEQUENCE
C = Third

DIGITS 5,6,7 — NOMINAL CAPACITY
C20 = 20 Tons C55 = 55 Tons
C25 = 25 Tons C60 = 60 Tons
C30 = 30 Tons C70 = 70 Tons
C40 = 40 Tons C75 = 75 Tons
C50 = 50 Tons

DIGIT 8 — POWER SUPPLY (See Note 1)
1 = 460/60/3 PWS A = 380/50/3 PWS
2 = 575/60/3 PWS B = 415/50/3 PWS
3 = 230/60/3 PWS C = 380/50/3 XL
4 = 460/60/3 XL D = 415/50/3 XL
5 = 575/60/3 XL E = 200/60/3 XL
6 = 200/60/3 PWS F = 230/60/3 XL

DIGIT 9 — HEATING CAPACITY
H = High Heat
L = Low Heat
0 = No Heat
Note: When the second digit is "E" for electric heat, the following values apply in the ninth digit:
D = 30 KW R = 130 KW
H = 50 KW U = 150 KW
L = 70 KW V = 170 KW
N = 90 KW W = 190 KW
Q = 110 KW

DIGIT 10 — DESIGN SEQUENCE
A = First (Factory Assigned)
B = Second, etc.

DIGIT 11 — EXHAUST
0 = None 7 = 100%, 15 HP
1 = Barometric 8 = 100%, 20 HP
2 = 100%, 1½ HP A = 50%, 1½ HP
3 = 100%, 3 HP B = 50%, 3 HP
4 = 100%, 5 HP C = 50%, 5 HP
5 = 100%, 7½ HP D = 50%, 7½ HP
6 = 100%, 10 HP

DIGIT 12 — EXHAUST AIR FAN DRIVE SELECTION
0 = None 8 = 800 RPM
4 = 400 RPM 9 = 900 RPM
5 = 500 RPM A = 1000 RPM
6 = 600 RPM B = 1100 RPM
7 = 700 RPM

DIGIT 13 — FILTER
A = Throwaway
B = Cleanable Wire Mesh
C = High-Efficiency Throwaway
D = 90-95% Bag With Prefilters
E = 90-95% Cartridge With Prefilters
F = No Filters (T/A Rack)
G = No Filters (Bag/Cart. Rack)

DIGIT 14 — SUPPLY AIR FAN HP
1 = 3 HP 6 = 20 HP
2 = 5 HP 7 = 25 HP
3 = 7½ HP 8 = 30 HP
4 = 10 HP 9 = 40 HP
5 = 15 HP

DIGIT 15 — SUPPLY AIR FAN DRIVE SELECTIONS
5 = 500 RPM A = 1000 RPM
6 = 600 RPM B = 1100 RPM
7 = 700 RPM C = 1200 RPM
8 = 800 RPM D = 1300 RPM
9 = 900 RPM E = 1400 RPM
F = 1500 RPM

DIGIT 16 — FRESH AIR SELECTION
A = No Fresh Air
B = 0-25% Manual
D = 0-100% Economizer

DIGIT 17 — SYSTEM CONTROL
1 = Constant Volume Electronic — Room Thermostat
3 = Variable Air Volume Electronic Supply Air With FROSTAT™

DIGIT 18 — ACCESSORY PANEL
A = None
B = Signal Light Connection For Field Supplied Panel
C = Remote Panel
D = Remote Panel With Night Setback

DIGIT 19 — AMBIENT CONTROL
0 = Standard 1 = 0 F

DIGIT 20 — AGENCY APPROVAL
0 = None 1 = UL 2 = CSA
(Only One Agency Approval Can Be Ordered)

DIGIT 21 — MISCELLANEOUS (See Note 2)
A = Unit Disconnect Switch
B = Hot Gas Bypass
E = Ultra Low Leak Fresh Air Dampers
F = High Duct Temperature Thermostat
G = High Capacity Option (N/A on 70 Ton)
H = Copper Condenser Fins
J = Remote Setpoint (VAV only)
K = Zone Reset (VAV only)
L = High-Efficiency Motors
M = Fast Warm-Up Thermostat (VAV Only)
N = Inlet Vanes — Supply Fan With Controls
R = Extended Grease Lines
T = Access Doors
X = Compressor Lockout Thermostat (Economizer Only)
Y = ICS Control Option-Tracer Integration Module (TIM)
8 = Two-Inch Spring Isolators

NOTE:
1. 20 through 60-ton units available in XL only.
2. When the second digit calls for "L" or "S", one of the following valve size values must be in digit 21 (Misc.):
1 = ½" 2 = ¾" 3 = 1" 4 = 1¼" 5 = 1½" 6 = 2"
3. SEHC units (units with electric heat) utilizing 208V or 230V require dual power source.

EXAMPLE:
Model numbers: SFHCC254HC00B39A1A10L describes a unit with the following characteristics: DX cooling with natural gas heating, 25 ton nominal cooling capacity, 460/60/3 power supply, high heat model. No exhaust or drive selection, cleanable wire mesh filters, 7½ hp supply fan motor, supply fan drive selection No. 9 — (900 RPM), no fresh air, constant volume control, no accessory panel, 0 F ambient control, no agency approval and high-efficiency motors.

TRANE

General Data

Table 8-1 — General Data — 20-40 Ton

	20 Ton		25 Ton		30 Ton		40 Ton	
Compressor Data								
Number/Size (Nominal)	2/10 Ton		1/10 Ton, 1/15 Ton		2/15 Ton		4/10 Ton	
Model	Scroll		Scroll		Scroll		Scroll	
Unit Capacity Steps (%)	100/50		100/40		100/50		100/75/50/25	
RPM	3450		3450		3450		3450	
Evaporator Fans								
Number/Size/Type	2/15"/FC		2/15"/FC		2/18"/FC		2/20"/FC	
Hp Range	3-10		3-15		5-20		7½-25	
Cfm Range[1]	4000-9000		5000-11000		6000-13500		8000-18000	
TSP Range — (In. WG)	0.25-4.0		0.25-4.0		0.25-4.0		0.25-4.0	
Exhaust Fans	50%	100%	50%	100%	50%	100%	50%	100%
Number/Size/Type	1/15"/FC	2/15"/FC	1/15"/FC	2/15"/FC	1/15"/FC	2/15"/FC	1/18"/FC	2/18"/FC
Hp Range	1.5-3	1.5-3	1.5-3	3-5	3-5	3-7.5	5-7.5	5-10
Cfm Range	2000-6000	4000-10000	2000-6000	4000-12000	2000-7000	4000-14000	3000-11000	6000-16000
ESP Range — (In. WG)	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0
Condenser Fans								
Number/Size/Type	2/26"/Prop.		3/26"/Prop.		3/26"/Prop.		4/26"/Prop.	
Hp (Each)	1.0		1.0		1.0		1.0	
Cfm	13600		18300		20900		28200	
Cycle/Phase	60/3		60/3		60/3		60/3	
Evaporator Coil — Standard								
Size (Ft²)	16.3		20.3		24.4		32.8	
Rows/Fin Series	2/144		2/144		2/144		2/144	
Tube Diameter/Surface	½/Enhanced		½/Enhanced		½/Enhanced		½/Enhanced	
Evaporator Coil — High Capacity								
Size (Ft²)	16.3		20.3		24.4		32.5	
Rows/Fin Series	4/144		4/144		4/144		4/144	
Tube Diameter/Surface	½/Enhanced		½/Enhanced		½/Enhanced		½/Enhanced	
Condenser Coil (Aluminum Fins)								
Size (Ft²)	35.0		35.0		46.3		63.2	
Rows/Fin Series/Tube Diameter	3/156/ ⅜		3/156/ ⅜		3/168/ ⅜		3/168/ ⅜	
Copper Condenser Fins (Optional)	3/144/ ⅜		3/144/ ⅜		3/156/ ⅜		3/156/ ⅜	
Electric Heat								
KW Range[2]	30-110		30-130		30-150		50-170	
Capacity Steps: CV/VAV	3/1		3/1		3/1		3/1	
Natural Gas Heat								
Low Heat Input	235		235		350		350	
High Heat Input	500		500		500		850	
Capacity Steps: CV/VAV	2/1		2/1		2/1		2/1	
Hot Water Coil								
Size (Inches)	30 × 66 × 2 Row		30 × 66 × 2 Row		30 × 66 × 2 Row		42 × 66 × 2 Row	
Type	Type W, Prima Flo		Type W, Prima Flo		Type W, Prima Flo		Type W, Prima Flo	
High Heat (Fins/Ft)	110		110		110		110	
Low Heat (Fins/Ft)	80		80		80		80	
Steam Coil								
Size (Inches)	30 × 66 × 1 Row		30 × 66 × 1 Row		30 × 66 × 1 Row		30 × 66 × 1 Row & 12 × 66 × 1 Row	
Type	Type NS		Type NS		Type NS		Type NS	
High Heat (Fins/Ft)	96		96		96		96	
Low Heat (Fins/Ft)	42		42		42		42	
Filters								
Panel Filters								
Number/Size (Inches)	12 — 20 × 20 × 2		12 — 20 × 20 × 2		16 — 20 × 20 × 2		16 — 20 × 25 × 2	
Face Area (Ft²)	33.3		33.3		44.4		55.5	
Bag Filters								
Number/Size (Inches)	4 — 12 × 24 × 19 3 — 24 × 24 × 19		4 — 12 × 24 × 19 3 — 24 × 24 × 19		2 — 12 × 24 × 19 6 — 24 × 24 × 19		5 — 12 × 24 × 19 6 — 24 × 24 × 19	
Cartridge Filters	4 — 12 × 24 × 12 3 — 24 × 24 × 12		4 — 12 × 24 × 12 3 — 24 × 24 × 12		2 — 12 × 24 × 12 6 — 24 × 24 × 12		5 — 12 × 24 × 12 6 — 24 × 24 × 12	
Prefilters (For Bag & Cartridge)	4 — 12 × 24 × 2 3 — 24 × 24 × 2		4 — 12 × 24 × 2 3 — 24 × 24 × 2		2 — 12 × 24 × 2 6 — 24 × 24 × 2		5 — 12 × 24 × 2 6 — 24 × 24 × 2	
Face Area (Ft²)	20.0		20.0		28.0		34.0	
Standard Unit Minimum Outside Air Temperature For Mechanical Cooling								
Without Hot Gas Option	55 F		50 F		50 F		55 F	
With Hot Gas Option	55 F		50 F		50 F		55 F	
Low Ambient Option Minimum Outside Air Temperature								
Without Hot Gas Option	0 F		0 F		0 F		0 F	
With Hot Gas Option	10 F		10 F		10 F		10 F	

Notes: —
1. For cfm values outside these ranges, refer to RT-EB-81.
2. Refer to Table 34-3 for availability of electric heat kw ranges by voltage.

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ECO B-8

General Data

Table 10-1 — General Data — 90-130 Ton

	90 Ton	105 Ton	115 Ton	130 Ton
Compressor Data				
Number/Size (Nominal)	2/40 Ton	1/40 Ton, 1/50 Ton	2/50 Ton	2/60 Ton
Model	Model R	Model R	Model R	Model R
Unit Capacity Steps (%)	100/75/50/25	100/78/44/22	100/75/50/25	100/75/50/25
RPM	1750	1750	1750	1750
Evaporator Fans				
Number/Size/Type	2/27"/FC	2/27"/FC	2/27"/FC	2/27"/FC
Hp Range	30-80	30-80	30-80	30-80
Cfm Range[1]	27,000-45,000	31,000-46,000	31,000-46,000	31,000-46,000
TSP Range — (In. WG)	1.0-4.75	1.0-4.70	1.0-4.70	1.0-4.70

Exhaust Fans	90 Ton 50%	90 Ton 100%	105 Ton 50%	105 Ton 100%	115 Ton 50%	115 Ton 100%	130 Ton 50%	130 Ton 100%
Number/Size/Type	1/22"/FC	2/22"/FC	1/22"/FC	2/22"/FC	1/22"/FC	2/22"/FC	1/22"/FC	2/22"/FC
Hp Range	15	15-40	15	15-40	15	15-40	15	15-40
Cfm Range	10,000-25,000	24,000-40,000	10,000-25,000	24,000-40,000	10,000-25,000	24,000-40,000	10,000-25,000	24,000-40,000
ESP Range — (In. WG)	.25-2.5	.25-2.5	.25-2.5	.25-2.5	.25-2.5	.25-2.5	.25-2.5	.25-2.5

	90 Ton	105 Ton	115 Ton	130 Ton
Condenser Fans				
Number/Size/Type	8/26"/Prop.	9/26"/Prop.	10/26"/Prop.	12/26"/Prop.
Hp (Each)	1.0	1.0	1.0	1.0
Cfm	59,200	63,200	70,222	84,267
Cycle/Phase	60/3	60/3	60/3	60/3
Evaporator Coil — Standard				
Dimensions	122.0 x 70.0	122.0 x 71.25	122.0 x 71.25	122.0 x 71.25
Size (Ft²)	59.3	60.4	60.4	60.4
Rows/Fin Series	3/120	4/120	5/144	5/144
Tube Diameter/Surface	½/Enhanced	½/Enhanced	½/Enhanced	½/Enhanced
Evaporator Coil — High Capacity				
Dimensions	122.0 x 70.0	122.0 x 71.25	NA	NA
Size (Ft²)	59.3	60.4	NA	NA
Hi-Capacity Rows/Fin Series	5/144	5/144	NA	NA
Tube Diameter/Surface	½/Enhanced	½/Enhanced	N/A	N/A
Condenser Coil				
Size (Ft²)	152	152	152	152
Rows/Fin Series/Tube Diameter	3/156/ ⅜	4/156/ ⅜	4/156/ ⅜	4/156/ ⅜
Electric Heat				
KW	190	190	190	190
Capacity Steps: CV/VAV	3/1	3/1	3/1	3/1
Natural Gas Heat				
MBh Input	1000	1000	1000	1000
Capacity Steps: CV/VAV	2/1	2/1	2/1	2/1
Filters				
Panel Filters				
Number/Size (Inches)	25-24x24x2	25-24x24x2	25-24x24x2	25-24x24x2
Face Area (Ft²)	100.0	100.0	100.0	100.0
Bag Filters	3-12x24x19	3-12x24x19	3-12x24x19	3-12x24x19
Number/Size (Inches)	15-24x24x19	15-24x24x19	15-24x24x19	15-24x24x19
Cartridge Filters	3-12x24x12	3-12x24x12	3-12x24x12	3-12x24x12
	15-24x24x12	15-24x24x12	15-24x24x12	15-24x24x12
Prefilters (For Bag & Cartridge)	3-20x24x2	3-20x24x2	3-20x24x2	3-20x24x2
	15-24x24x2	15-24x24x2	15-24x24x2	15-24x24x2
Face Area (Ft²)	66.0	66.0	66.0	66.0

Notes:
1. For cfm values outside these ranges, refer to RT-EB-81.
2. Refer to Table 34-3 for availability of electric heat kw ranges by voltage.
3. Single step of heating capacity provided on units with VAV option.

Table 10-2 — ARI Performance Data[1]

ARI Performance Data[1]				
Tons	Model[3]	Capacity (MBh)	EER	IPLV[2]
20	SAHCC2040Y**A**A*****	218	9.0	11.8
	SXHCC2040Y**A**A*****	218	9.0	11.8
	SFHCC204LY**A**A*****	218	8.9	11.7
	SEHCC204*Y**A**A*****	218	8.9	11.7
	SLHCC204LY**A**A*****	216	8.9	11.6
	SSHCC204LY**A**A*****	218	8.9	11.7

Notes:
1. This information is rated in accordance to the ARI Standard 360-86 for large unitary equipment up to 20 tons. These Trane products can be found in the current ARI Directory.
2. IPLV — Integrated Part Load Value
3. This information applies to units whose design sequence (Digit 10) is "Y" or later.

Table 10-3 — ARI Correction Multipliers

	Model		Multipliers (%)		
Option Description	Digit	Designator	Capacity	EER	IPLV[2]
200/60/3 Voltage	8	E	100	100	100
230/60/3 Voltage	8	F	101	99	99
High Heat — Gas	9	H	100	100	100
High Heat — Steam	9	H	100	99	98
High Heat — Hot Water	9	H	100	99	99
Wire Mesh Filter	13	B	100	101	101
95% Bag filter	13	D	99	95	91
95% Cartridge Filter	13	E	99	95	92
100% Economizer	16	D	100	99	98
High Capacity Coil	21	G	113	109	107
High Efficiency Motor	21	L	100	101	101
Inlet Guide Vanes	21	N	100	99	99

Table 10-4 — Economizer Outdoor Air Damper Leakage (Of Rated Airflow)

	ΔP Across Dampers (In. WC)	
	0.5 (In.)	1.0 (In.)
Standard "Low Leak"	1.5 %	2.5 %
Optional "Ultra Low Leak"	0.5 %	1.0 %

Note:
Above data based on tests completed in accordance with AMCA Standard 575 at AMCA Laboratories.

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Performance Data

Table 40-1 — Supply Fan Performance WITHOUT INLET VANES — 40, 50 and 55 Ton "C" Style

Cfm Std Air	.250 Rpm	.250 Bhp	.500 Rpm	.500 Bhp	.750 Rpm	.750 Bhp	1.000 Rpm	1.000 Bhp	1.250 Rpm	1.250 Bhp	1.500 Rpm	1.500 Bhp	1.750 Rpm	1.750 Bhp	2.000 Rpm	2.000 Bhp
8000	290	.66	396	1.27	479	1.95	550	2.67	613	3.44	671	4.23	723	5.05	770	5.90
9000	298	.77	400	1.44	482	2.16	553	2.93	616	3.75	673	4.61	725	5.49	774	6.39
10000	311	.94	404	1.61	486	2.38	556	3.20	618	4.07	675	4.99	727	5.93	776	6.89
11000	329	1.16	409	1.79	490	2.63	559	3.50	621	4.41	677	5.37	729	6.37	778	7.40
12000	349	1.43	414	2.00	494	2.89	563	3.81	624	4.77	680	5.78	731	6.82	780	7.90
13000	370	1.75	424	2.26	499	3.16	567	4.15	628	5.16	683	6.21	734	7.30	782	8.43
14000	391	2.12	438	2.60	504	3.44	571	4.49	632	5.57	687	6.67	737	7.80	785	8.97
15000	413	2.54	455	3.01	510	3.77	576	4.86	636	5.99	690	7.15	741	8.33	789	9.55
16000	435	3.02	474	3.50	520	4.18	581	5.24	640	6.43	695	7.65	745	8.89	792	10.16
17000	457	3.54	494	4.06	534	4.68	586	5.65	645	6.89	699	8.17	749	9.47	796	10.79
18000	479	4.13	515	4.68	550	5.29	595	6.15	650	7.37	703	8.71	753	10.07	800	11.46
19000	501	4.78	536	5.38	569	5.98	607	6.76	656	7.89	708	9.27	758	10.70	804	12.14
20000	524	5.49	558	6.15	588	6.75	622	7.49	664	8.50	713	9.85	762	11.34	809	12.84
21000	546	6.28	580	7.00	608	7.61	639	8.32	676	9.25	719	10.49	767	12.00	813	13.57
22000	569	7.14	602	7.92	629	8.55	658	9.26	690	10.12	728	11.25	773	12.70	818	14.32
22500	580	7.60	613	8.40	640	9.05	667	9.76	698	10.60	734	11.68	776	13.07	820	14.70
23000	591	8.08	624	8.90	651	9.58	677	10.29	706	11.11	740	12.15	780	13.48	823	15.09
24000	614	9.10	646	9.97	672	10.70	697	11.41	724	12.22	754	13.19	789	14.41	829	15.93

Cfm Std Air	2.250 Rpm	2.250 Bhp	2.500 Rpm	2.500 Bhp	2.750 Rpm	2.750 Bhp	3.000 Rpm	3.000 Bhp	3.250 Rpm	3.250 Bhp	3.500 Rpm	3.500 Bhp	3.750 Rpm	3.750 Bhp	4.000 Rpm	4.000 Bhp
8000	814	6.80	854	7.73	892	8.69	927	9.67	961	10.66	993	11.67	1023	12.69	1053	13.71
9000	819	7.32	861	8.28	901	9.27	938	10.31	972	11.37	1006	12.45	1037	13.55	1068	14.67
10000	822	7.88	865	8.89	906	9.92	944	10.98	980	12.07	1015	13.20	1048	14.35	1079	15.53
11000	824	8.45	867	9.52	908	10.61	948	11.72	985	12.85	1021	14.00	1055	15.18	1087	16.40
12000	826	9.01	869	10.15	910	11.30	950	12.47	988	13.66	1024	14.87	1059	16.09	1092	17.34
13000	828	9.59	871	10.78	912	11.99	952	13.23	989	14.48	1026	15.75	1061	17.04	1095	18.34
14000	830	10.18	873	11.42	914	12.69	954	13.98	991	15.30	1028	16.63	1063	17.98	1097	19.35
15000	833	10.80	876	12.09	917	13.40	956	14.75	994	16.12	1030	17.51	1065	18.92	1099	20.35
16000	837	11.46	879	12.78	920	14.14	958	15.54	996	16.96	1032	18.40	1067	19.87	1101	21.36
17000	840	12.14	882	13.52	923	14.92	961	16.36	999	17.82	1035	19.32	1069	20.83	1103	22.38
18000	844	12.86	886	14.28	926	15.73	964	17.21	1002	18.72	1037	20.26	1072	21.82	1106	23.41
19000	848	13.60	890	15.06	930	16.58	968	18.11	1005	19.66	1040	21.24	1075	22.85	1108	24.48
20000	852	14.36	894	15.90	934	17.46	972	19.04	1008	20.64	1044	22.27	1078	23.92	1111	25.60
21000	857	15.15	898	16.75	938	18.37	976	20.00	1012	21.66	1047	23.33	1081	25.03	1114	26.75
22000	861	15.96	902	17.63	942	19.30	980	20.99	1016	22.70	1051	24.43	1085	26.18	1118	27.95
22500	864	16.38	905	18.07	944	19.78	982	21.50	1018	23.24	1053	25.00	1087	26.77	1120	28.57
23000	866	16.80	907	18.52	946	20.26	984	22.01	1020	23.78	1055	25.57	1089	27.37	1122	29.19
24000	871	17.66	912	19.45	951	21.25	988	23.06	1024	24.89	1059	26.73	1093	28.59	1125	30.47

Cfm Std Air	4.250 RPM	4.250 BHP	4.500 RPM	4.500 BHP	4.750 RPM	4.750 BHP	5.000 RPM	5.000 BHP
8000	1081	14.75	1108	15.78	1134	16.83	1160	17.88
9000	1097	15.80	1125	16.94	1152	18.08		
10000	1109	16.73	1138	17.95	1166	19.18		
11000	1118	17.64	1148	18.91				
12000	1124	18.61	1155	19.91				
13000	1128	19.65	1159	20.99				
14000	1130	20.73	1162	22.12				
15000	1132	21.80	1164	23.26				
16000	1134	22.86	1166	24.39				
17000	1136	23.94	1168	25.52				
18000	1138	25.03	1170	26.66				
19000	1141	26.15						
20000	1144	27.30						
21000	1147	28.50						
22000	1150	29.74						
22500	1152	30.38						
23000	1153	31.03						
24000	1157	32.38						

Notes:
1. Fan performance for 40, 50, and 55 ton "C" style rooftops is identical. However, note maximum motor hp size for each size. Contact your local Trane representative for information on oversized motors.
2. Shaded areas at table extremes note non-standard Bhp or Rpm selection. Contact your local Trane representative for more information.
3. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops (evaporator coil, filters, optional economizer, optional exhaust fan, optional heating system, optional cooling only extended casing, optional roof curb).
4. Maximum Cfm (for UL approval) as follows: 40 Ton — 18,000 Cfm
   50 Ton — 22,500 Cfm
   55 Ton — 24,000 Cfm
5. Minimum motor horsepower is 7.5 hp.
6. Maximum motor horsepower as follows: 40 Ton — 25 hp
   50 Ton — 30 hp
   55 Ton — 30 hp

Mid-table shading indicates maximum motor horsepower divisions.
7. Maximum 7.5 hp through 15 hp motor Rpm is 1,141 Rpm.
8. See RT-EB-81 for further details.

Shading indicates non-standard horsepower.

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September 1991
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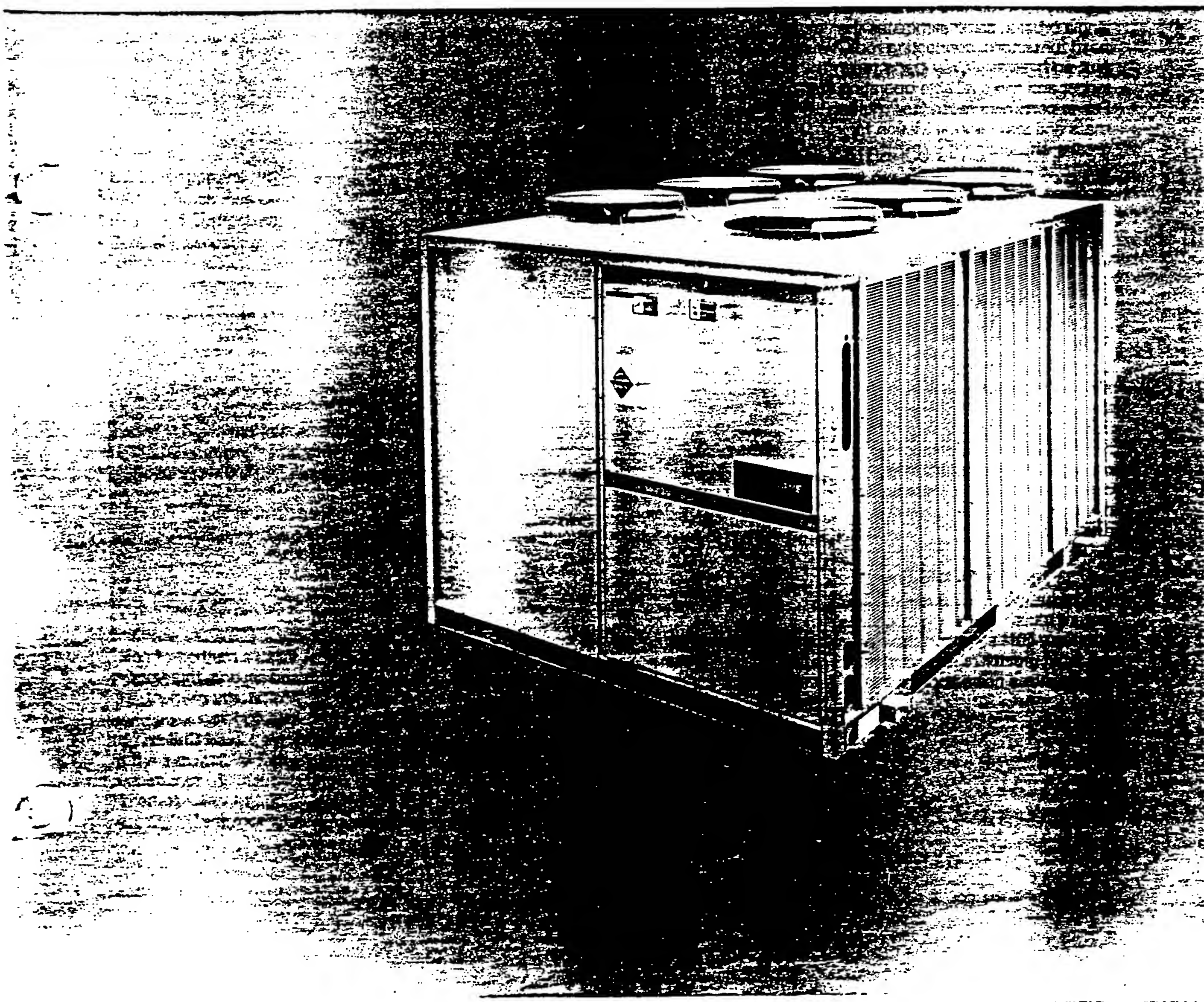
Split System Condensing Units And Remote Chillers

20 through 120 Tons

20 TON UNITS BLDGS 205, 207, 208, 230, 229
[illegible] TON UNIT BLDG 201
[illegible] TON UNIT BLDG 51
[illegible] TON UNIT BLDG 51



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General Data

BLDG 205
208
207
236
229

BLDG 81

BLDG 301

BLDG 81

Table 6-1 — General Data — 20-120 Ton Condensing Units

Nominal Tonnage / Model Number	20 RAUC-C20	25 RAUC-C25	30 RAUC-C30	40 RAUC-C40	50 RAUC-C50	60 RAUC-C60	80 RAUC-C80	100 RAUC-D10	120 RAUC-D12
Compressor Data									
Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Model R Semi-Hermetic	Model R Semi-Hermetic	Model R Semi-Hermetic
Manifolded Sets									
Circuit #1	10T+10T	10T+15T	15T+15T	10T+10T	10T+15T	15T+15T	40T	50T	60T
Circuit #2	N/A	N/A	N/A	10T+10T	10T+15T	15T+15T	40T	50T	60T
Unit Capacity Steps (%)	100-50	100-40	100-50	100-75-50-25	100-80-60-30	100-75-50-25			
No Control & VAV Option							100-75-50-25	100-67-50-33	100-67-50-33
EVP Option							100-75-50-25	100-83-67-50-33-16	100-83-67-50-33-16
Condenser Fan Data									
Quantity/Fan Dia./Type	2/26"/Prop.	3/26"/Prop.	3/26"/Prop.	4/26"/Prop.	6/26"/Prop.	6/26"/Prop.	8/26"/Prop.	12/26"/Prop.	12/26"/Prop.
Fan Drive Type	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct
No. of Motors/Hp Each	2/1.0	3/1.0	3/1.0	4/1.0	6/1.0	6/1.0	8/1.0	12/1.0	12/1.0
Nominal Total Cfm	14000	18300	20900	28200	35600	40800	49600	66800	76000
Condenser Coil Data									
Number of Coils/Size (Inches)	1/63x71	1/71x71	1/45x71 1/49x71	2/65x70	2/51x96	2/66x96	4/65x70	4/51x96	4/66x96
Face Area (Sq. Ft.)	31.0	35.0	46.1	63.2	67.1	88.0	126.4	134.2	176.0
Rows/Fins Per Ft.	3/168	3/156	3/168	3/168	3/156	3/168	3/168	3/156	3/168
Condenser Storage Capacity (Lbs) (2)	67	76	96	136	142	184	272	284	368
Refrigerant Data									
No. Refrigerant Circuits	1	1	1	2	2	2	2	2	2
Refrigerant Type	R-22	R-22	R-22	R-22	R-22	R-22	R-22	R-22	R-22
Refrigerant Operating Charge (Lbs) (1)	28	31	40	58	62	80	116	124	160
Minimum Outdoor Air Temperature For Mechanical Cooling									
Standard Ambient Operating Range (F)	40-115	40-115	40-115	40-115	40-115	40-115	40-115	40-115	40-115
Low Ambient Option (F)	0	0	0	0	0	0	0	0	0

Notes:
1. Operating charge is approximate for condensing unit only, and does not include charge for low side or interconnecting lines.
2. Condenser storage capacity is given at conditions of 95 F outdoor temperature, and 95% full.

Table 6-2 — Evaporator Chillers — 20-120 Tons

Nominal Tonnage	20	25	30	40	50	60	80	100	120
No. Of Circuits	1	1	1	2	2	2	2	2	2
Volume Shell (Gal) (1)	11.7	10.7	16.3	13.8	21.0	18.5	43.1	35.0	47.9
Tube Pull (In.) (2)	73	73	74	74	96	96	95	95	95
Refrigerant Operating Charge (Lbs) (3)	8	10	12	16	20	24	26.8	33.4	40.4

Notes:
1. Shell volume is for waterside only.
2. Tube pull given is length of the evaporator.
3. Operating charge is approximate and for the evaporator chiller only.

Table 6-3 — EER Data — Condensing Unit Only (1)

Nominal Tonnage	Model Number	Net Capacity (MBH)	Total Unit Compressor KW	Condenser Fan KW Each/Total	Control KW	Condensing Unit Total KW	Condensing Unit EER
20	RAUC-C20	239	20.1	0.9/1.8	0.25	22.2	10.8
25	RAUC-C25	312	26.0	0.9/2.7	0.25	29.0	10.8
30	RAUC-C30	374	31.2	0.9/2.7	0.25	34.2	10.9
40	RAUC-C40	505	40.2	0.9/3.6	0.40	44.2	11.4
50	RAUC-C50	621	52.4	0.9/5.4	0.40	58.2	10.7
60	RAUC-C60	744	62.8	0.9/5.4	0.40	68.6	10.8
80	RAUC-C80	1049	91.6	0.9/7.2	0.50	99.3	10.6
100	RAUC-D10	1337	109.0	0.9/10.8	0.50	120.3	11.1
120	RAUC-D12	1633	133.8	0.9/10.8	0.50	145.1	11.3

Notes:
1. Condensing unit only ratings are per ARI 365. Full load ratings are at 95 F entering air temperature, and refrigerant conditions entering the condensing unit of 45 F saturated and 60 F actual temperature. Part load ratings are at 80 F entering air temperature and refrigerant conditions entering the condensing unit of 50 F saturated suction and 65 F actual temperature. For use of 200/230 volt unit in 230 volt applications: increase capacity rating by 1%, increase power by 1.5% and decrease efficiency by 1%. All capacity, kw and EER figures are at conditions of 45 F saturated suction temperature at the compressor and 95 F ambient.

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Performance Data

Chart 15-1 — 80 Ton Condensing Unit Performance — RAUC-C80 (60 HZ)

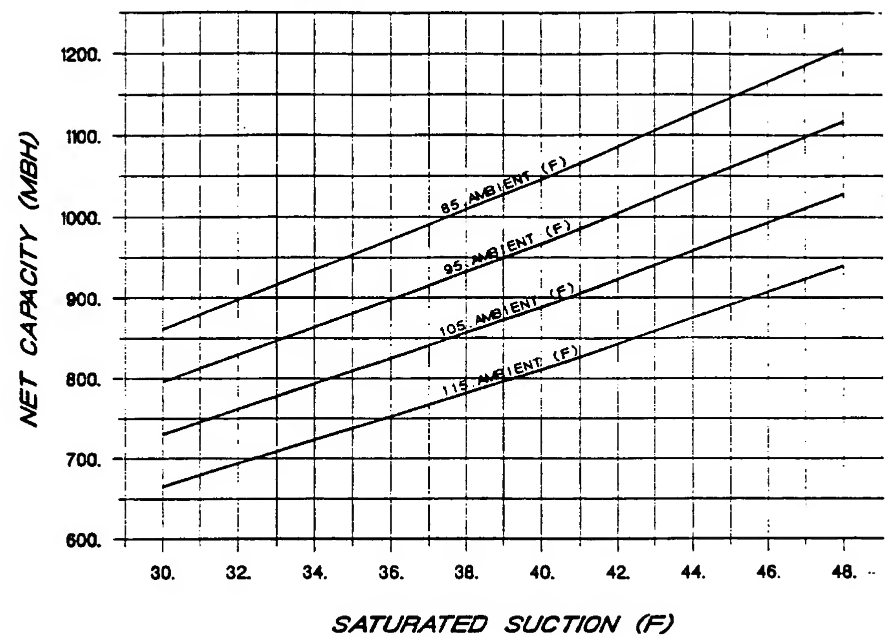
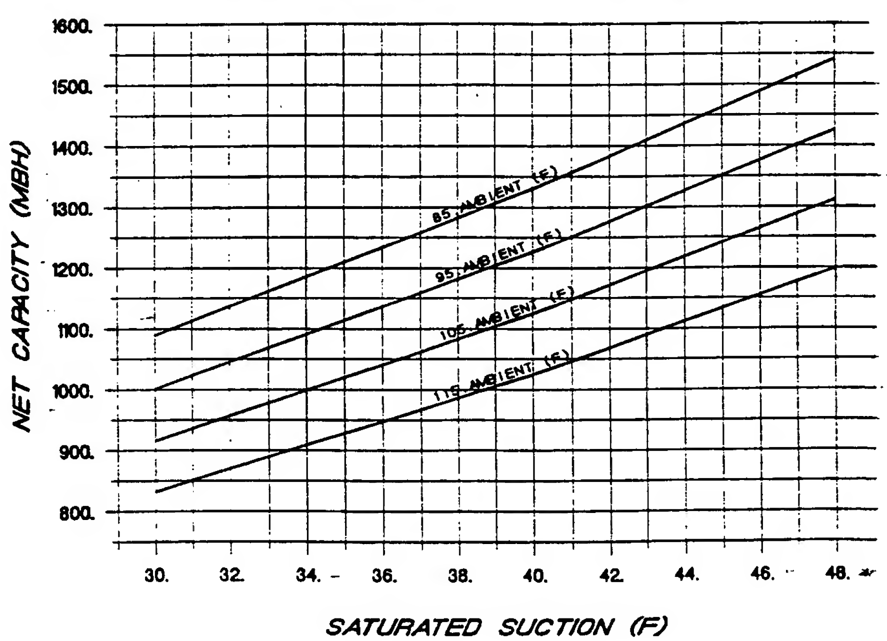


Chart 15-2 — 100 Ton Condensing Unit Performance — RAUC-D10 (60 HZ)



Electrical Data

Table 19-1 — Condensing Units

Nominal Tons	Model Number	Unit Characteristics: Voltage/Start Characteristics	Allowable Voltage Utilization Range	Minimum Circuit Ampacity (3), (6)	Maximum Fuse Size (4), (6)	Recommended Dual Element Fuse Size (5), (6)	Number Of Compressors
20	RAUC-C20G	200-230/60/3XL	180-220/208-254	101	125	125	2
	RAUC-C204	460/60/3XL	416-508	44	60	50	2
	RAUC-C205	575/60/3XL	520-635	35	45	40	2
25	RAUC-C25G	200-230/60/3XL	180-220/208-254	129	175	150	2
	RAUC-C254	460/60/3XL	416-508	56	80	70	2
	RAUC-C255	575/60/3XL	520-635	45	60	60	2
30	RAUC-C30G	200-230/60/3XL	180-220/208-254	148	200	175	2
	RAUC-C304	460/60/3XL	416-508	65	90	80	2
	RAUC-C305	575/60/3XL	520-635	52	70	60	2
40	RAUC-C40G	200-230/60/3XL	180-220/208-254	192	225	225	4
	RAUC-C404	460/60/3XL	416-508	84	100	90	4
	RAUC-C405	575/60/3XL	520-635	67	80	80	4
50	RAUC-C50G	200-230/60/3XL	180-220/208-254	244	300	300	4
	RAUC-C504	460/60/3XL	416-508	106	125	125	4
	RAUC-C505	575/60/3XL	520-635	85	100	90	4
60	RAUC-C60G	200-230/60/3XL	180-220/208-254	282	300	300	4
	RAUC-C604	460/60/3XL	416-508	123	125	125	4
	RAUC-C605	575/60/3XL	520-635	98	110	110	4
80	RAUC-C802	575/60/3PW	520-635	137	175	175	2
	RAUC-C803	230/60/3PW	208-254	343	450	400	2
	RAUC-C804	460/60/3XL	416-508	171	225	200	2
	RAUC-C805	575/60/3XL	520-635	137	175	175	2
	RAUC-C806	200/60/3PW	180-220	394	500	450	2
100	RAUC-D102	575/60/3PW	520-635	155	200	175	2
	RAUC-D103	230/60/3PW	208-254	390	500	450	2
	RAUC-D104	460/60/3XL	416-508	195	250	225	2
	RAUC-D105	575/60/3XL	520-635	155	200	175	2
	RAUC-D106	200/60/3PW	180-220	448	600	500	2
120	RAUC-D122	575/60/3PW	520-635	191	250	225	2
	RAUC-D123	230/60/3PW	208-254	480	600	600	2
	RAUC-D124	460/60/3XL	416-508	240	300	300	2
	RAUC-D125	575/60/3XL	520-635	191	250	225	2
	RAUC-D126	200/60/3PW	180-220	551	700	700	2

Table 19-2 — Compressor Motor And Condenser Fan Data

Nominal Tons	Model	Voltage	Compressor A (7) RLA	Compressor A (7) LRA	Compressor B RLA	Compressor B LRA	Compressor C RLA	Compressor C LRA	Compressor D RLA	Compressor D LRA	Condenser Fans Qty.	Condenser Fans FLA
20	RAUC C20	200/230 XL	41.4	247	41.4	247	—	—	—	—	2	4.1
		460	18.1	95	18.1	95	—	—	—	—	2	1.8
		575	14.4	76	14.4	76	—	—	—	—	2	1.4
25	RAUC C25	200/230 XL	60.5	376	41.4	247	—	—	—	—	3	4.1
		460	26.3	142	18.1	95	—	—	—	—	3	1.8
		575	21.0	114	14.4	76	—	—	—	—	3	1.4
30	RAUC C30	200/230 XL	60.5	376	60.5	376	—	—	—	—	3	4.1
		460	26.3	142	26.3	142	—	—	—	—	3	1.8
		575	21.0	114	21.0	114	—	—	—	—	3	1.4
40	RAUC C40	200/230 XL	41.4	247	41.4	247	41.4	247	41.4	247	4	4.1
		460	18.1	95	18.1	95	18.1	95	18.1	95	4	1.8
		575	14.4	76	14.4	76	14.4	76	14.4	76	4	1.4
50	RAUC C50	200/230 XL	60.5	376	41.4	247	60.5	376	41.4	247	6	4.1
		460	26.3	142	18.1	95	26.3	142	18.1	95	6	1.8
		575	21.0	114	14.4	76	21.0	114	14.4	76	6	1.4
60	RAUC C60	200/230 XL	60.5	376	60.5	376	60.5	376	60.5	376	6	4.1
		460	26.3	142	26.3	142	26.3	142	26.3	142	6	1.8
		575	21.0	114	21.0	114	21.0	114	21.0	114	6	1.4
			(1)	(2)								
80	RAUC C80	200 PWS	160.3	430/729	—	—	—	—	—	—	8	4.1
		230 PWS	139.4	375/631	—	—	—	—	—	—	8	3.6
		460 XL	69.7	315	—	—	—	—	—	—	8	1.8
		575 PWS	55.8	150/246	—	—	—	—	—	—	8	1.4
		575 XL	55.8	245	—	—	—	—	—	—	8	1.4
100	RAUC D10	200 PWS	177.1	550/910	—	—	—	—	—	—	12	4.1
		230 PWS	154.0	480/792	—	—	—	—	—	—	12	4.1
		460 XL	77.0	396	—	—	—	—	—	—	12	1.8
		575 PWS	61.6	190/315	—	—	—	—	—	—	12	1.4
		575 XL	61.6	315	—	—	—	—	—	—	12	1.4
120	RAUC D12	200 PWS	223.1	620/990	—	—	—	—	—	—	12	4.1
		230 PWS	194.0	535/860	—	—	—	—	—	—	12	3.6
		460 XL	97.0	430	—	—	—	—	—	—	12	1.8
		575 PWS	77.6	220/346	—	—	—	—	—	—	12	1.4
		575 XL	77.6	346	—	—	—	—	—	—	12	1.4

Notes: —
(1) For 80 through 120-ton units, electrical values shown are for each compressor.
(2) Where two (2) RLA values are shown, the first value is PWS, the second value is XL.
(3) Minimum circuit ampacity (MCA) is 125 percent of the RLA of one compressor motor plus the total RLA of the remaining motors.
(4) Maximum fuse size permitted by N.E.C. 440-22 is 225 percent of one compressor motor RLA plus the total RLA of the remaining motors.
(5) Recommended dual element fuse size is 150 percent of the RLA of one compressor motor plus the total RLA of the remaining motors.
(6) Local codes may take precedence.
(7) Value given is per compressor on 20-60 ton units

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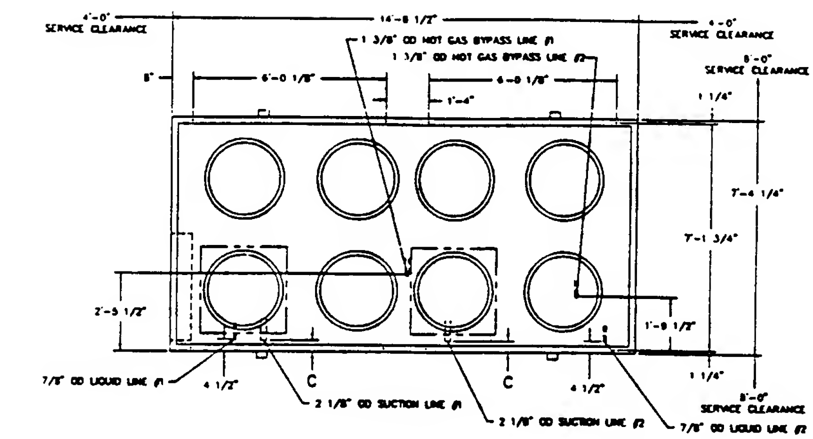
Dimensional Data

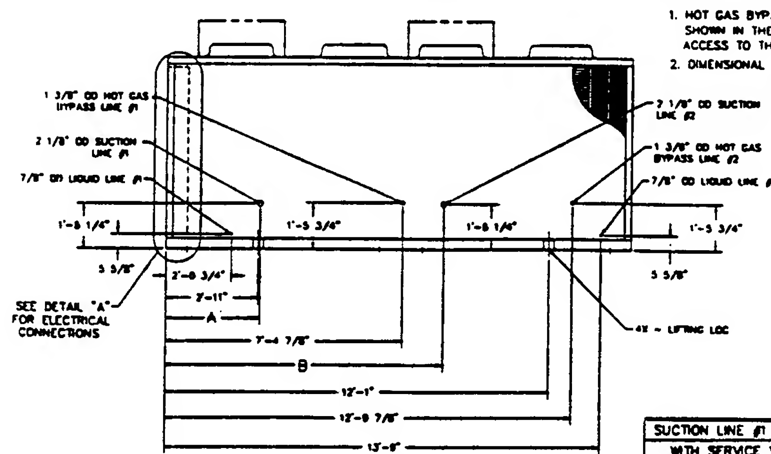
Figure 26-1 — Air-Cooled Condensing Unit — RAUC 80 Ton



TOP VIEW

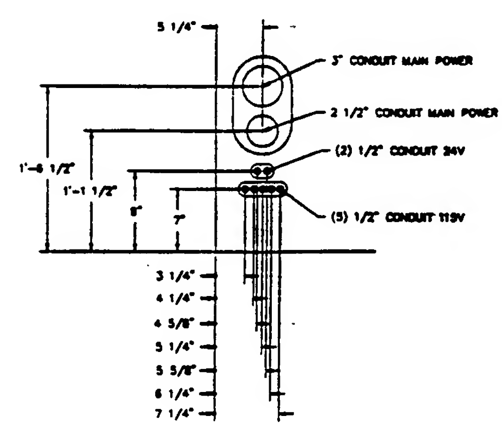
NOTES:

1. HOT GAS BYPASS, SUCTION AND LIQUID LINE CONNECTION LOCATIONS SHOWN IN THE FRONT VIEW DO NOT REPRESENT HOLES IN THE UNIT PANEL. ACCESS TO THESE CONNECTIONS ARE PROVIDED BY THE CUSTOMER.
2. DIMENSIONAL TOLERANCE IS ± 1/8".

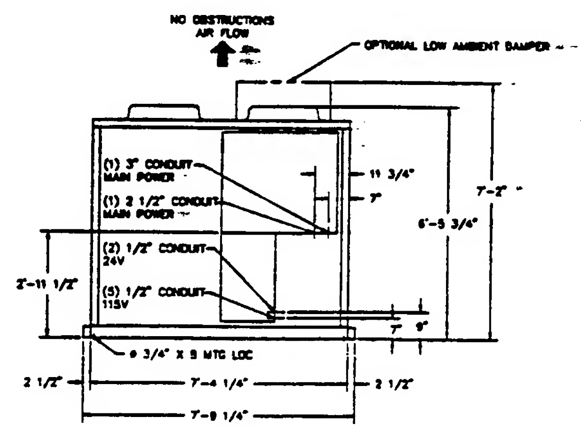


FRONT VIEW

SUCTION LINE #1 AND #2	A	B	C
WITH SERVICE VALVE	2'-11 3/4"	8'-8 1/2"	2 3/4"
WITHOUT SERVICE VALVE	2'-6 3/8"	8'-3 1/8"	6 1/4"



DETAIL "A"
(PANEL ACCESS TO ELECTRICAL CONNECTIONS)



SIDE VIEW

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ECO B-8

TRANE™

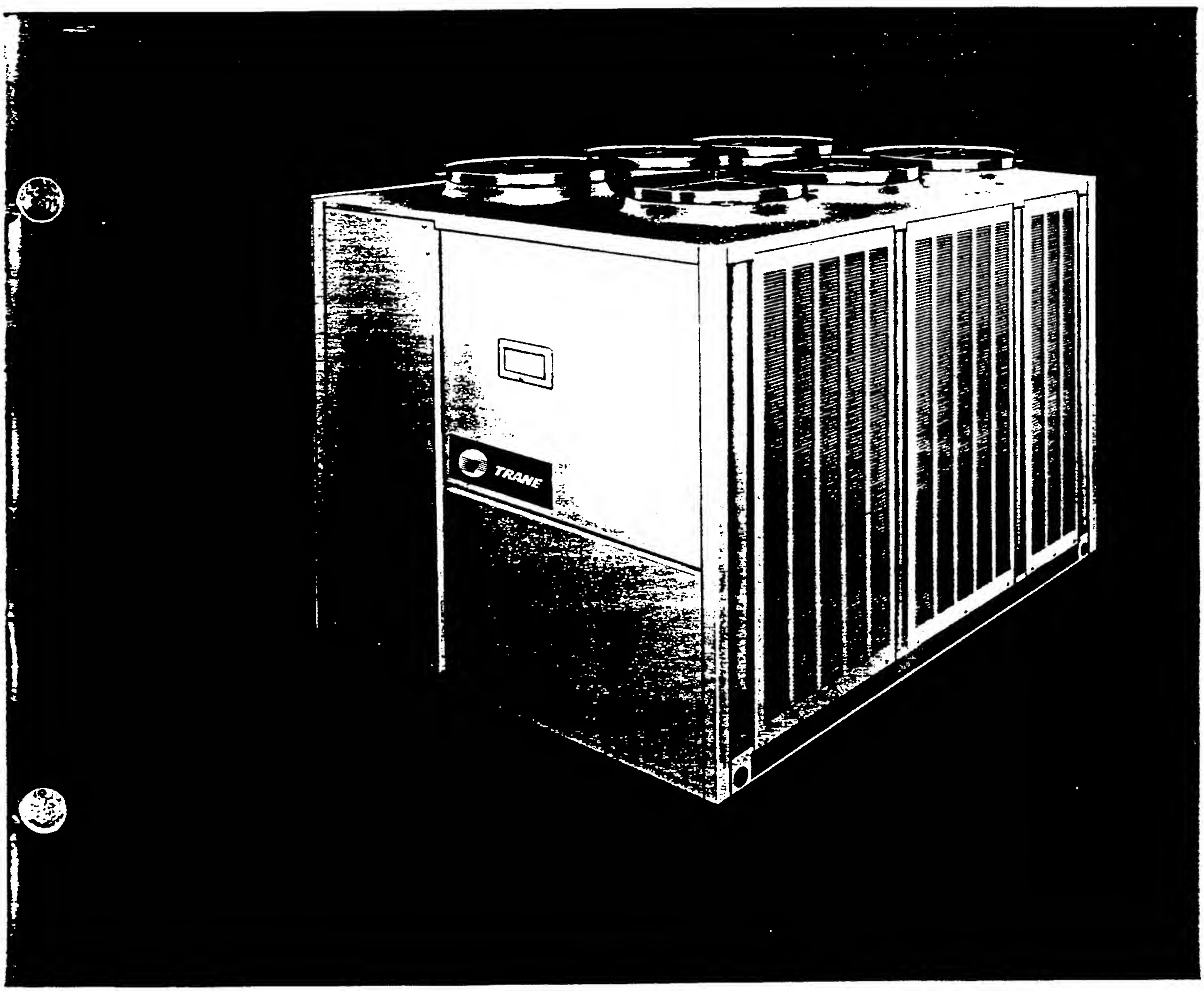
CG-DS-1
September 1992

Air-Cooled Liquid Chillers

10 through 120-Tons

PAGES 210, 290 25 TON UNIT

PAGE 301 20 TON UNIT



TRANE

General Data

BLDG 101 — BLDGS 210, 290

Table 14-1 — General Data — 10-60 Ton Units

Model Number	10 Ton CGA120	15 Ton CGA 180	20 Ton CGAD-C20	25 Ton CGAD-C25	30 Ton CGAD-C30	40 Ton CGAD-C40	50 Ton CGAD-C50	60 Ton CGAD-C60
Compressor Data								
Model	Climatuff™	Trane H	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity	2	2	2	1/1	2	4	2/2	4
Nominal Tons Per Compressor	5	7.5	10	10/15	15	10	10/15	15
Evaporator								
Nominal Size (Tons)	10	15	20	25	30	40	50	60
Water Storage Capacity (Gallons) (2)	1.4	1.5	11.7	10.7	16.3	13.8	21.0	18.6
Min. Flow Rate (GPM)	12.0	18.0	24	30	36	48	60	72
Max. Flow Rate (GPM)	36.0	54.0	72	90	108	144	180	216
Max EWT At Start-Up — Deg F (3)	100	100	108	108	108	108	108	108
Condenser								
Nominal Size (Tons)	10	15	20	25	30	40	50	60
Number of Coils	1	2	1	1	2	2	2	2
Coil Size (ea., Inches)[4]	28 x 108	28 x 83	55 x 71	61 x 71	45 x 71/35 x 71	56 x 70	44 x 96	57 x 96
Number of Rows	2	2	3	3	3	3	3	3
Subcooler Size (ea., Inches)	4 x 108	4 x 83	8 x 71	10 x 71	14 x 71	9 x 70	7 x 96	9 x 96
Condenser Fans								
Quantity	1	2	2	3	3	4	6	6
Diameter (Inches)	28"	26"	26	26	26	26	26	26
CFM (Total)	8,120	11,600	14,000	18,300	20,900	28,200	35,600	40,800
Nominal RPM	1100	1100	1140	1140	1140	1140	1140	1140
Tip Speed (Ft/Min)	8060	7490	7750	7750	7750	7750	7750	7750
Motor HP (ea.)	1	1/2	1.0	1.0	1.0	1.0	1.0	1.0
Drive Type	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct
Minimum Outdoor Air Temperature Permissible For Mechanical Cooling (1)								
Standard Ambient Control Unit (Deg. F)	50	45	30	30	30	30	30	30
Standard Ambient with Hot Gas Bypass (Deg. F)	60	60	40	40	40	40	40	40
Low Ambient Option (Deg. F)	0	0	0	0	0	0	0	0
Low Ambient Control With Hot Gas Bypass (Deg. F)	15	15	10	10	10	10	10	10
General Unit								
Unload Steps	100-50	100-50	100-50	100-60-40	100-50	100-75-50-25	100-80-60-30	100-75-50-25
No. of Independent Refrigerant Circuits	2	2	1	1	1	2	2	2
Refrigerant Charge (lbs. R22/Circuit)	9.5	12.4	36.5	41.5	60.0	76.0	76.0	100.0
Oil Charge (Pints/Circuit)	4.2	7.5	8.0	8.0/14.0	14.0	8.0	8.0/14.0	14.0

*Unloading steps depend upon which compressor is lead compressor.

Note:
(1) Minimum start-up ambient based on unit at minimum step of unloading and a 5 mph wind across the condenser.
(2) Includes piping internal to chiller.
(3) At 95 F ambient.
(4) Does not include subcooling portion of coil.

TRANE

Performance Data

10-30 Ton
Full Load

Table 26-1 — 10 Ton — CGA 120

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	9.2	8.6	11.6	8.7	9.2	10.2	8.2	9.8	9.1	7.6	10.3	8.1	7.0	10.8	7.1
42	9.5	8.7	11.8	9.0	9.3	10.5	8.5	9.9	9.3	7.9	10.5	8.2	7.3	11.0	7.2
44	9.8	8.8	12.0	9.3	9.5	10.7	8.8	10.1	9.5	8.1	10.7	8.4	7.5	11.3	7.4
45	10.0	8.9	12.2	9.5	9.5	10.8	8.9	10.2	9.5	8.3	10.8	8.4	7.7	11.4	7.4
46	10.2	8.9	12.3	9.6	9.6	10.9	9.0	10.3	9.6	8.4	10.9	8.5	7.8	11.5	7.5
48	10.5	9.0	12.5	9.9	9.8	11.1	9.3	10.4	9.8	8.7	11.1	8.6	8.0	11.7	7.6
50	10.8	9.1	12.8	10.2	9.9	11.3	9.6	10.6	10.0	9.0	11.3	8.8	8.3	11.9	7.7
55	11.6	9.4	13.3	11.0	10.2	11.8	10.4	11.0	10.4	9.7	11.8	9.1	9.0	12.5	8.0
60	12.4	9.7	13.9	11.8	10.6	12.2	11.1	11.4	10.7	10.4	12.3	9.4	9.7	13.1	8.2

Table 26-2 — 15 Ton — CGA 180

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	15.6	14.9	11.7	14.5	15.7	10.4	13.4	16.3	9.3	12.3	16.8	8.2	11.2	17.3	7.3
42	16.1	15.2	11.9	15.0	16.0	10.6	13.9	16.7	9.4	12.8	17.3	8.4	11.6	17.8	7.4
44	16.7	15.5	12.1	15.6	16.4	10.7	14.4	17.0	9.6	13.3	17.7	8.5	12.1	18.2	7.5
45	17.0	15.7	12.2	15.8	16.5	10.8	14.7	17.3	9.6	13.5	17.9	8.6	12.3	18.4	7.6
46	17.2	15.8	12.3	16.1	16.7	10.9	14.9	17.5	9.7	13.8	18.1	8.6	12.6	18.7	7.7
48	17.8	16.1	12.4	16.6	17.0	11.0	15.5	17.8	9.8	14.3	18.5	8.7	13.0	19.1	7.8
50	18.4	16.4	12.6	17.2	17.4	11.2	16.0	18.2	9.9	14.8	18.9	8.9	13.5	19.6	7.9
55	19.8	17.2	13.0	18.6	18.2	11.6	17.3	19.2	10.3	16.0	20.0	9.1	14.7	20.8	8.1
60	21.3	18.0	13.4	20.0	19.1	11.9	18.6	20.1	10.6	17.3	21.1	9.4	16.0	21.9	8.3

Table 26-3 — 20 Ton — CGAD-C20

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	18.7	16.0	12.3	17.8	17.7	10.7	16.8	19.6	9.2	15.8	21.8	7.9	14.7	24.2	6.7
42	19.3	16.2	12.6	18.4	17.9	11.0	17.4	19.8	9.5	16.3	22.0	8.1	15.3	24.4	6.9
44	19.9	16.3	12.9	19.0	18.1	11.2	18.0	20.0	9.7	16.9	22.2	8.3	15.8	24.6	7.1
45	20.3	16.4	13.1	19.3	18.1	11.4	18.2	20.1	9.8	17.2	22.3	8.4	16.1	24.8	7.2
46	20.6	16.5	13.2	19.6	18.2	11.5	18.5	20.2	9.9	17.5	22.4	8.5	16.3	24.9	7.3
48	21.2	16.6	13.5	20.2	18.4	11.8	19.1	20.4	10.2	18.0	22.6	8.7	16.9	25.1	7.4
50	21.9	16.8	13.8	20.8	18.6	12.0	19.7	20.6	10.4	18.6	22.8	8.9	17.5	25.3	7.6
55	23.5	17.2	14.5	22.4	19.0	12.7	21.3	21.1	11.0	20.1	23.4	9.5	18.9	25.9	8.1
60	25.3	17.7	15.3	24.1	19.5	13.3	22.9	21.6	11.6	21.7	23.9	10.0			

Table 26-4 — 25 Ton — CGAD-C25

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	23.3	20.8	11.7	22.2	22.9	10.2	21.0	25.3	8.9	19.8	28.0	7.6	18.5	31.0	6.5
42	24.0	21.0	12.0	22.9	23.1	10.5	21.7	25.6	9.1	20.4	28.3	7.8	19.1	31.3	6.7
44	24.8	21.2	12.2	23.8	23.4	10.7	22.4	25.8	9.3	21.1	28.5	8.0	19.8	31.5	6.9
45	25.2	21.3	12.4	24.0	23.5	10.8	22.8	25.9	9.4	21.5	28.7	8.1	20.1	31.7	6.9
46	25.6	21.5	12.5	24.4	23.6	11.0	23.1	26.1	9.5	21.8	28.8	8.2	20.5	31.8	7.0
48	26.4	21.7	12.8	25.2	23.9	11.2	23.9	26.3	9.8	22.5	29.1	8.4	21.1	32.1	7.2
50	27.2	21.9	13.1	26.0	24.1	11.5	24.6	26.6	10.0	23.3	29.3	8.6	21.8	32.4	7.4
55	29.3	22.5	13.7	27.8	24.8	12.1	26.6	27.2	10.5	25.1	30.0	9.1	23.6	33.1	7.8
60	31.4	23.1	14.4	30.0	25.4	12.7	28.6	27.9	11.1	27.1	30.7	9.6			

Table 26-5 — 30 Ton — CGAD-C30

	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
LWT (Deg F)	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER	Capacity (Tons)	Input KW	EER
40	27.9	24.4	12.2	26.8	27.0	10.6	25.3	29.8	9.2	23.9	33.0	8.0	22.4	36.5	6.8
42	28.8	24.6	12.5	27.5	27.2	10.9	26.2	30.1	9.5	24.7	33.3	8.2	23.2	36.8	7.0
44	29.8	24.9	12.8	28.5	27.5	11.2	27.1	30.4	9.7	25.6	33.6	8.4	24.0	37.2	7.2
45	30.3	25.0	12.9	28.9	27.7	11.3	27.5	30.6	9.8	26.0	33.8	8.5	24.4	37.3	7.3
46	30.7	25.2	13.1	29.4	27.8	11.4	27.9	30.7	9.9	26.4	34.0	8.6	24.8	37.5	7.3
48	31.7	25.4	13.3	30.3	28.1	11.7	28.8	31.0	10.1	27.3	34.3	8.8	25.7	37.8	7.5
50	32.7	25.7	13.6	31.3	28.4	11.9	29.8	31.3	10.4	28.2	34.6	9.0	26.5	38.2	7.7
55	35.2	26.4	14.3	33.7	29.1	12.6	32.1	32.1	10.9	30.5	35.4	9.5	28.7	39.1	8.2
60	37.9	27.1	15.1	36.3	29.9	13.2	34.6	32.9	11.5	32.8	36.3	10.0			

Notes:
1. 20-30 ton ratings based on a 0.0005 fouling factor at sea level per ARI standard 590-81, 10-15 ton ratings based on 0.00025 fouling factor per ARI 590-86.
2. Interpolation between points is permissible.
3. Extrapolation beyond points is not permissible.
4. Kw input is for compressors only.
5. EER = Energy Efficiency Ratio. (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Ratings are based on an evaporator temperature drop of 10 F.
7. Derate capacity 1% for 208 volt ceprabon of 208-230 dual voltage units.

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Performance Data

10-80 Tons Part Load

Table 29-1 — Part Load Data, ARI Points (10-80 Tons)

			Entering Condenser Air Temperature (Degrees F)							
Tons	Model Number		95 100% Load	87 80% Load	85 75% Load	79 60% Load	75 50% Load	71 40% Load	67 30% Load	65 25% Load
10	CGA 120	EER	9.5	—	—	—	11.6	—	—	—
		Capacity (Tons)	8.8	—	—	—	4.8	—	—	—
		KW Input	10.1	—	—	—	4.0	—	—	—
15	CGA 180	EER	9.6	—	—	—	11.1	—	—	—
		Capacity (Tons)	14.4	—	—	—	7.6	—	—	—
		KW Input	17.0	—	—	—	7.1	—	—	—
20	CGAD-C20	EER	9.7	—	—	—	13.9	—	—	—
		Capacity (Tons)	18.0	—	—	—	10.8	—	—	—
		KW Input	20.0	—	—	—	7.1	—	—	—
25	CGAD-C25	EER	9.3	—	—	12.5	—	13.7	—	—
		Capacity (Tons)	22.4	—	—	15.3	—	11.2	—	—
		KW Input	25.8	—	—	11.6	—	6.7	—	—
30	CGAD-C30	EER	9.7	—	—	—	14.0	—	—	—
		Capacity (Tons)	27.1	—	—	—	16.0	—	—	—
		KW Input	30.4	—	—	—	10.6	—	—	—
40	CGAD-C40	EER	9.7	—	11.2	—	14.1	—	—	15.0
		Capacity (Tons)	35.2	—	28.1	—	21.4	—	—	10.9
		KW Input	39.6	—	25.4	—	14.0	—	—	6.4
80	CGAD-C50	EER	9.3	10.8	—	12.6	—	—	14.0	—
		Capacity (Tons)	44.4	37.8	—	30.6	—	—	15.7	—
		KW Input	51.6	35.4	—	23.2	—	—	10.2	—
60	CGAD-C60	EER	9.5	—	11.1	—	14.1	—	—	15.2
		Capacity (Tons)	52.7	—	41.8	—	31.9	—	—	16.3
		KW Input	60.8	—	39.0	—	21.2	—	—	9.6
70	CGAC-C70	EER	9.9	—	10.5	—	11.8	—	—	13.4
		Capacity (Tons)	62.5	—	50.8	—	34.3	—	—	21.8
		KW Input	70.0	—	52.6	—	31.8	—	—	16.4
80	CGAC-C80	EER	9.7	—	10.6	—	12.1	—	—	13.3
		Capacity (Tons)	73.9	—	62.0	—	40.7	—	—	25.1
		KW Input	83.4	—	61.6	—	36.2	—	—	18.3

Notes:
1. Table 29-1 data is rated in accordance with ARI Standard 590-81, Section 7.3.
   — 44 F leaving chilled water temperature.
   — (55 F + 0.4 F x % Load) = entering ambient temperature.
   — Constant evaporator waterflow as determined at full load operation at 95 F ambient and 10 F evaporator temperature drop.
   — % Load by compressor displacement as defined by ARI Standard 590-81.
2. Kw input is for compressors only.
3. EER = Energy Efficiency Ratio, (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.

Performance Data

90-120 Tons Part Load

Table 30-1 — Part Load Data, ARI Points (90-120 Tons)

Tons	Model Number		Entering Condenser Air Temperature (Degrees F) 95 100% Load	88.3 83% Load	87.8 82% Load	86.2 78% Load	81.6 67% Load	80.6 64% Load	77.4 56% Load
90	CGAC-C90	EER	10.0	—	—	10.8	—	—	12.3
		Capacity (Tons)	85.9	—	—	73.2	—	—	51.4
		KW Input	92.9	—	—	70.5	—	—	44.3
100	CGAC-D10	EER	10.1	11.1	—	—	10.9	—	—
		Capacity (Tons)	94.5	86.6	—	—	71.4	—	—
		KW Input	100.4	82.6	—	—	64.4	—	—
110	CGAC-D11	EER	10.3	—	11.3	—	—	11.1	—
		Capacity (Tons)	105.6	—	95.5	—	—	76.6	—
		KW Input	112.3	—	90.5	—	—	69.1	—
120	CGAC-D12	EER	10.2	11.2	—	—	10.9	—	—
		Capacity (Tons)	114.2	104.0	—	—	85.2	—	—
		KW Input	122.6	100.7	—	—	79.0	—	—

Table 30-2 — Part Load Data, ARI Points (90-120 Tons)

Tons	Model Number		Entering Condenser Air Temperature (Degrees F) 75 50% Load	73 45% Load	69.8 37% Load	68.3 33% Load	67 30% Load	62.6 19% Load	61.6 17% Load	61 15% Load
90	CGAC-C90	EER	—	—	14.1	—	—	14.0	—	—
		Capacity (Tons)	—	—	40.8	—	—	21.9	—	—
		KW Input	—	—	28.7	—	—	18.7	—	—
100	CGAC-D10	EER	12.6	—	—	14.4	—	—	14.3	—
		Capacity (Tons)	52.1	—	—	41.2	—	—	22.0	—
		KW Input	43.6	—	—	28.3	—	—	14.3	—
110	CGAC-D11	EER	—	13.2	—	—	14.9	—	—	14.7
		Capacity (Tons)	—	54.3	—	—	42.4	—	—	22.4
		KW Input	—	43.6	—	—	28.1	—	—	14.1
120	CGAC-D12	EER	12.7	—	—	14.3	—	—	13.2	—
		Capacity (Tons)	62.5	—	—	48.6	—	—	25.3	—
		KW Input	52.9	—	—	34.9	—	—	18.8	—

Table 30-3 — Integrated Part Load Values

Tons	Model No.	IPLV
10	CGA 120	11.3
15	CGA 180	11.0
20	CGAD-C20	12.7
25	CGAD-C25	12.4
30	CGAD-C30	12.8
35	CGAD-C40	13.3
40	CGAD-C50	12.7
60	CGAD-C60	13.3
70	CGAC-C70	11.7
80	CGAC-C80	11.8
90	CGAC-C90	12.5*
100	CGAC-D10	12.4
110	CGAC-D11	12.6*
120	CGAC-D12	12.3

Notes:
1. Integrated Part Load Values are EERs in (Btu/watt-hour).
2. Values rated in accordance with ANSI/ASHRAE/IES Standard 90.1P.

*50 ton compressor leading.

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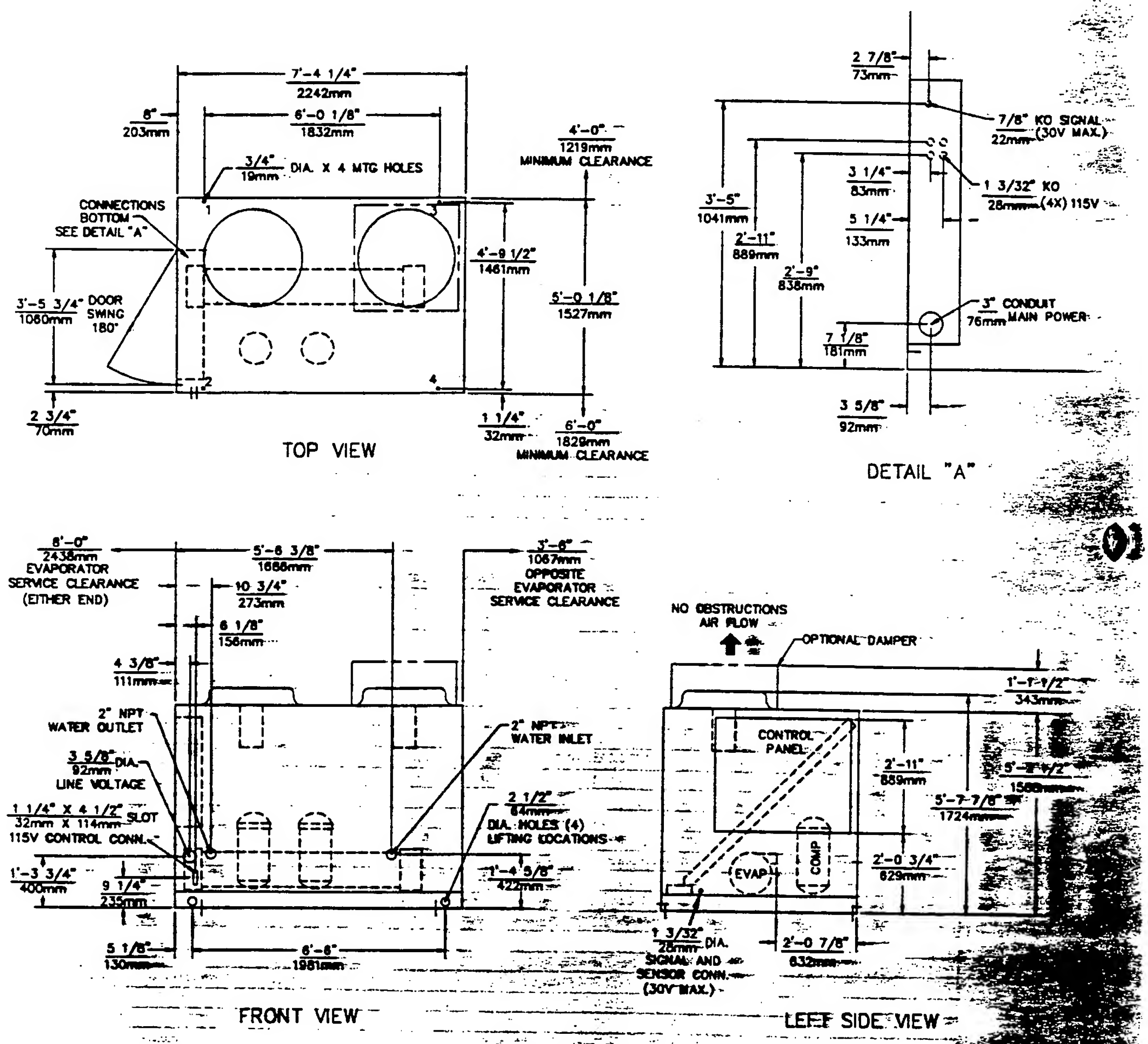
ECO B-8

Dimensional Data

20 Ton

Figure 44-1 — CGAD-C20 Unit Dimensions



Dimensional Data

25 Ton

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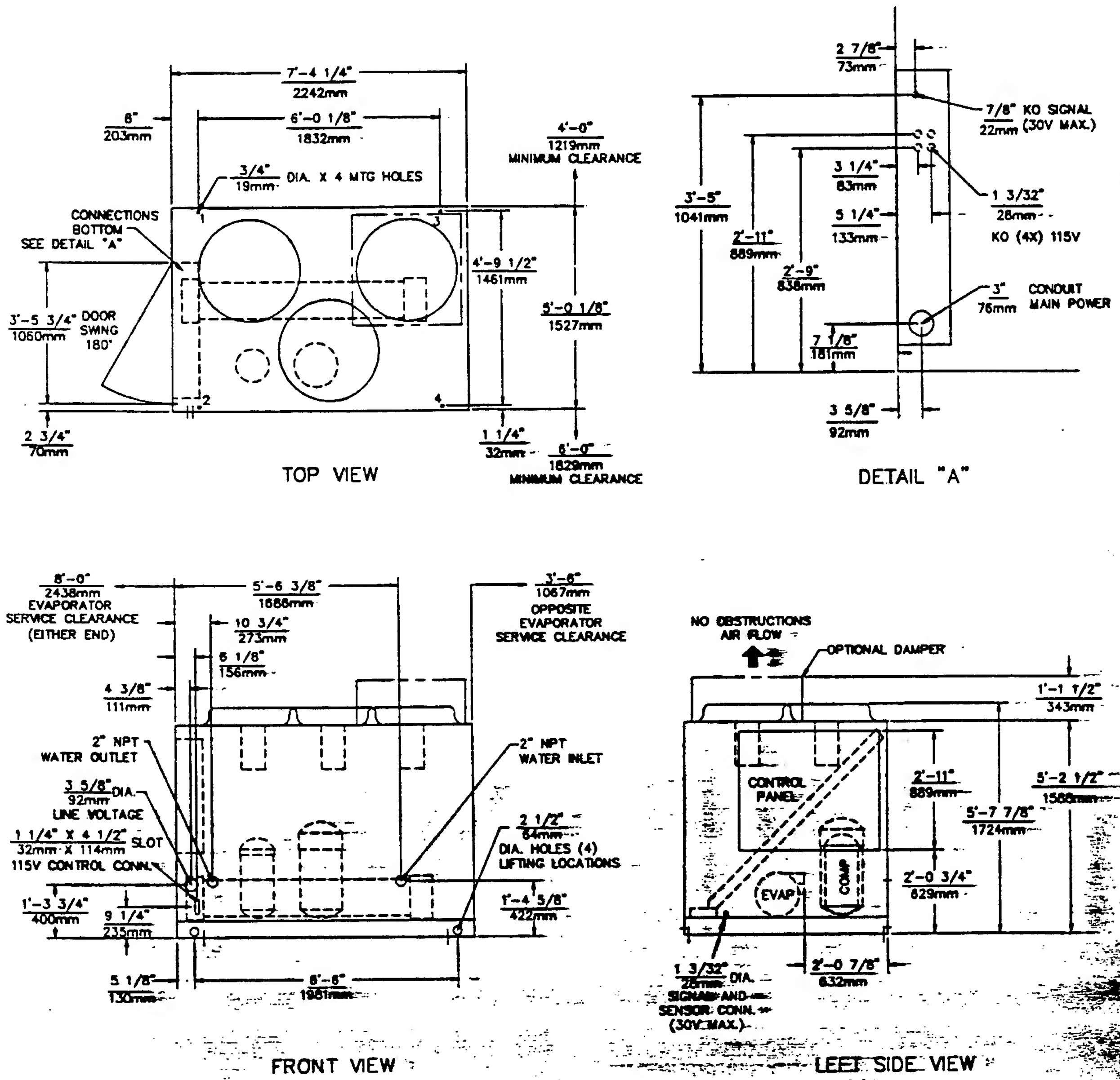
Figure 45-1 — CGAD-C25 Unit Dimensions

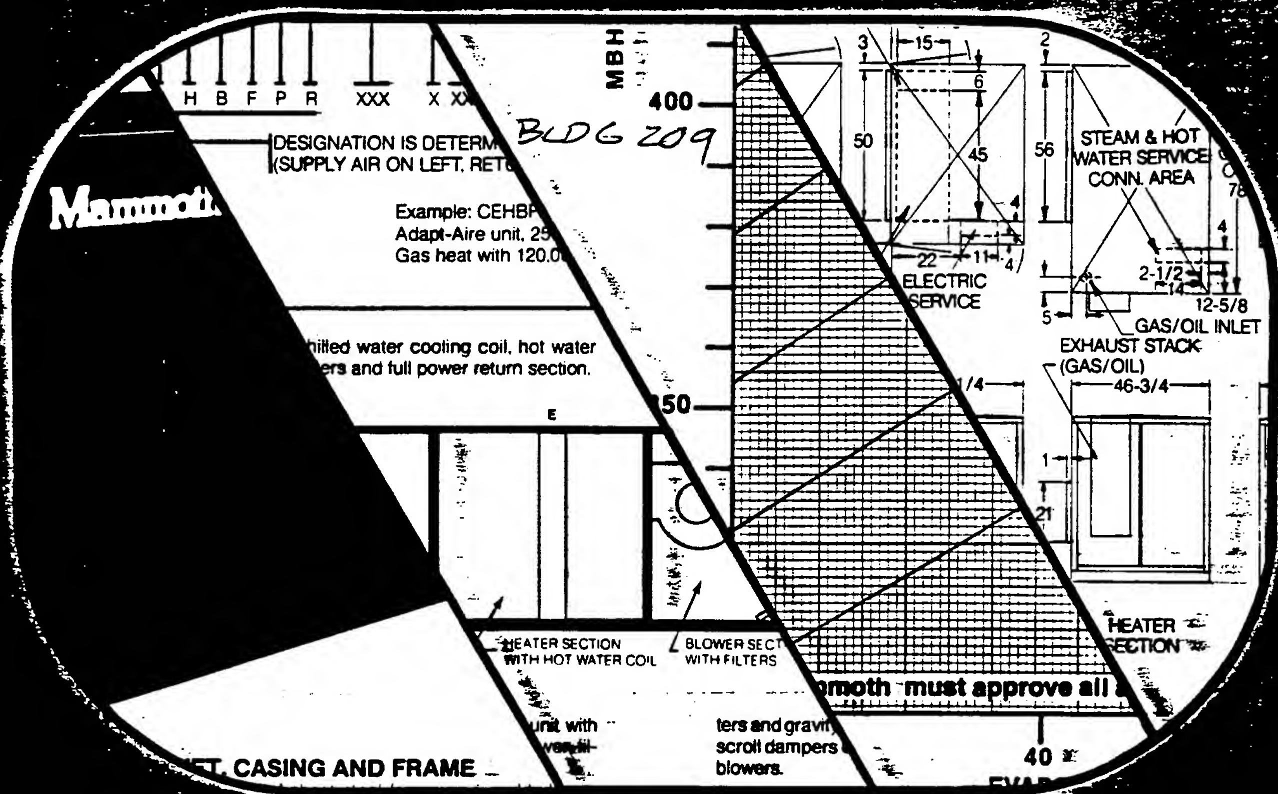


Mammoth®

Adapt-Aire

SERIES 3

10-60 TON



●SINGLE ZONE●MULTI-ZONE●VAV●
●COOLING ONLY●
●HEATING & VENTILATING●SUPERMARKET UNITS●
●100% MAKEUP AIR●HEATING & COOLING●
●WATER & AIR SOURCE HEAT PUMPS ● DUAL DUCT●

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UNIT DESIGNATION

CONDENSING "C" SECTION
(Remote Condensing Section designated RC)
CA - AIR COOLED CONDENSING SECTION
CW - WATER COOLED CONDENSING SECTION
AIR SOURCE HEAT PUMP "A" SECTION
WATER SOURCE HEAT PUMP "W" SECTION

EVAPORATOR "E" SECTION
HEATER "H" SECTION
BLOWER "B" SECTION
FILTER "F" SECTION (If Used As Option)
POWER RETURN EXHAUST "P" SECTION
RETURN "R"

FIRST TWO DIGITS INDICATE NOMINAL TONNAGE (DX or CW)
LAST DIGIT INDICATES NUMBER OF COMPRESSORS

HEATING MEDIUM:
(E) ELECTRIC HEAT
(S) STEAM HEAT
(W) HOT WATER
(G) GAS FIRED
(L) LIGHT OIL FIRED
G/L GAS/LIGHT OIL COMBINATION

M.B.H. HEATING CAPACITY (Output)

MULTI-ZONE OR DUAL DUCT (If applicable)
NUMBER OF ZONES (If applicable)
FRAME SIZE 1025 OR 2060

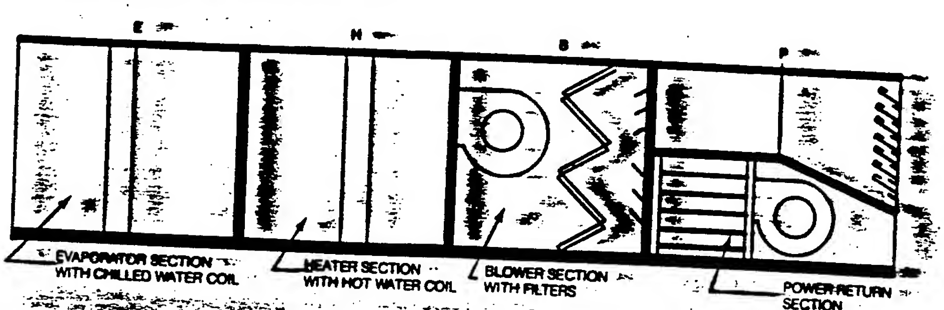
C A W E H B F P R XXX X XXX (MZ or DD XX) X

DESIGNATION IS DETERMINED BY ARRANGEMENT OF SECTIONS FROM LEFT TO RIGHT
(SUPPLY AIR ON LEFT, RETURN AIR ON RIGHT)

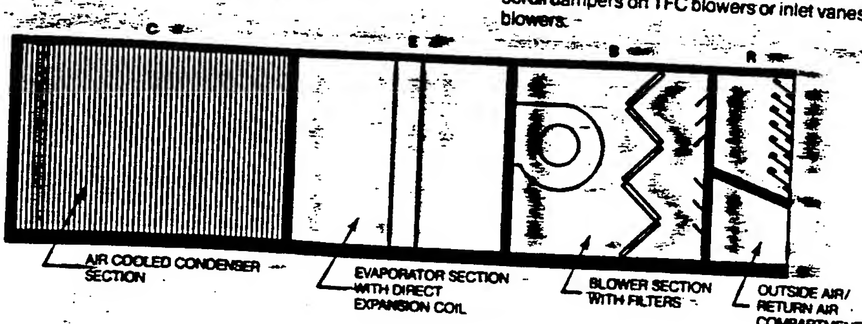
CEHB-181W258

Example: CEHBP 251 G 120 1025
Adapt-Aire unit, 25 ton capacity, one compressor, single zone.
Gas heat with 120,000 BTU heat output and power return.

I. Typical single zone unit with chilled water cooling coil, hot water heating coil, supply air blower, filters and full power return section.



II. Variable air volume (VAV) units: Shown is a cooling only unit with condenser, direct expansion evaporator coil, supply air blower, filters and gravity return air compartment. VAV units use either outlet or scroll dampers on TFC blowers or inlet vanes on single airfoil (SAD) blowers.



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ECO B-8

Table 1 FRAME AA-1025—NOMINAL CAPACITY AND MECHANICAL DATA

Section	MODEL NUMBER	111	112	151	162	181	201	202	251
	Nominal C F M Sz	4 500	4 500	6.100	6 300	7 200	8 000	8 000	10 500
	Nominal C F M Mz	4 500	4 500	6.100	6 300	7 200	8 000	8.000	8 000
	Nom. Tons Sz/Mz	11 6/11 6	11 3/11 3	15 3/15 3	15 8 15 8	20 3/20 3	23 2/23 2	23 0/23 0	27 9 27 1
CONDENSING SECTION	Compressor No /HP	(1) 10	(2) 5	(1) 15	(2) 7-1 2	(1) 20	(1) 25	(2) 10	(1) 30
CONDENSING SECTION	Compressor Type	Semihermetic							
CONDENSING SECTION	Compressor KW Input* 95°F Ambient 80°F/67°F	13 9	15 2	18 8	20 4	21 4	27 2	27 7	31 4
CONDENSING SECTION	Capacity Reduction (Optional)	Compressor Unloading or Hot Gas Bypass							
CONDENSING SECTION	Steps of Unloading (Optional)	100-67-0	100-50-0	100-67-0	100-50-0	100-50-0	100-50-0	100-67-50-33-0	100-67-33-0
CONDENSING SECTION	Condenser Coil Area Sq Ft	14 2	18 3	28 3	28 3	28 3	33.3	33.3	33 3
CONDENSING SECTION	Condenser Coil Rows	3	2	2	2	3	3	3	3
CONDENSING SECTION	Condenser Fans No./Size—Inches	(1) 36	(1) 36	(1) 36	(1) 36	(1) 36	(1) 36	(1) 36	(1) 42
CONDENSING SECTION	Condenser Fan HP	2	2	2	2	2	3	3	3
CONDENSING SECTION	Condenser C F M	8.500	11.000	13.700	13.700	12.800	14.900	14 900	17 000
CONDENSING SECTION	Water Cooled	Available—Refer to Mammoth Supplemental Water Cooled Catalog							
EVAPORATOR SECTION	Direct Expansion Coil Face Area—Sq Ft. Sz./Mz	10.0/10.0	10.0/10.0	13.3/13.3	13.3/13.3	13.3/13.3	13.3/13.3	13.3/13.3	17.5 13.3
EVAPORATOR SECTION	Standard Rows & Fins Sz /Mz	3E/3E	3E/3E	3E/3E	3E/3E	4E/4E	4F/4F	4F/4F	4E 6E
EVAPORATOR SECTION	Nominal Capacity MBH Sz./Mz. @ 80°F/67°F 95°F Ambient	139/139	135/135	184/184	190/190	243/243	278/278	276/276	335 325
EVAPORATOR SECTION	Optional Rows	3, 4, 5 & 6 Rows Available							
EVAPORATOR SECTION	Optional Fins	C, E & F Available							
EVAPORATOR SECTION	Chilled Water Coil Face Area—Sq. Ft. Sz./Mz.	9.8/9.8	9.8/9.8	13.1/13.1	13.1/13.1	13.1/13.1	13.1/13.1	13.1/13.1	17.1 13.1
HEATER SECTION	MBH Natural Gas Heat Output Range	120-500 Single Zone. 235-400 Multi Zone							
HEATER SECTION	MBH Oil Heat Output Range	120-500 Single Zone. 235-400 Multi Zone							
HEATER SECTION	MBH Propane Heat Output Range	120-500 Single Zone. 235-400 Multi Zone							
HEATER SECTION	MBH Electric Output Range At 460 Volts	114-950 Single Zone. 114-950 Multi Zone							
HEATER SECTION	MBH Range for Hot Water Coil Based on 200° Water ΔT 20° and 60°F/Air	70-800 Single Zone. 125-540 Multi Zone							
HEATER SECTION	Hot Water Coil Size—Sq. Ft.	13.0 Single Zone. 8.4 Multi Zone							
HEATER SECTION	Optional Rows	1, 2 3 & 4							
HEATER SECTION	Optional Fins	C, E & F							
HEATER SECTION	MBH Range for Steam Coil Based on 2# Steam and 60°F Air	230-790 Single Zone. 185-623 Multi Zone							
HEATER SECTION	Steam Coil Size—Sq. Ft.	13.0 Single Zone. 8.4 Multi Zone							
HEATER SECTION	Optional Rows	1 & 2							
HEATER SECTION	Optional Fins	C & E							
BLOWER SECTION SZ	Nominal CFM	4.500	4.500	6.100	6.300	7.200	8.000	8.000	10.500
BLOWER SECTION SZ	Blower Number & Size	(2) 12x12	(2) 12x12	(2) 12x12	(2) 12x12	(2) 15x11	(2) 15x11	(2) 15x11	(2) 15x11
BLOWER SECTION SZ	Nominal Motor Size**	1-1/2	1-1/2	3	3	5	5	5	7-1/2
BLOWER SECTION SZ	Maximum C.F.M.***	6.250	6.250	8.310	8.310	8.310	8.310	8.310	11.000
BLOWER SECTION MZ	Nominal C.F.M.	4.500	4.500	6.100	6.300	7.200	8.000	8.000	8.000
BLOWER SECTION MZ	Blower Number & Size	(2) 12x12	(2) 12x12	(2) 12x12	(2) 12x12	(2) 15x11	(2) 15x11	(2) 15x11	(2) 15x11
BLOWER SECTION MZ	Nominal Motor Size **	1-1/2	1-1/2	3	3	5	5	5	5
BLOWER SECTION MZ	Maximum C.F.M.***	6.250	6.250	8.310	8.310	8.310	8.310	8.310	8.310
BLOWER SECTION	Filters	See FILTER DATA							
BLOWER SECTION	Isolation (Optional)	Springs							
BLOWER SECTION	HP Range	1-10							
POWER RETURN SECTION	Blower No./Size	(2) 15x11							
POWER RETURN SECTION	C.F.M. Range	4.000-10.000							
POWER RETURN SECTION	Maximum E.S.P.	1.2							
POWER RETURN SECTION	HP Range	1/2—7-1/2							
POWER RETURN SECTION	Exhaust Dampers	Standard							
POWER RETURN SECTION	Isolation (Optional)	Springs							
MULTI-ZONE DECK	Number of Zones	1-10							

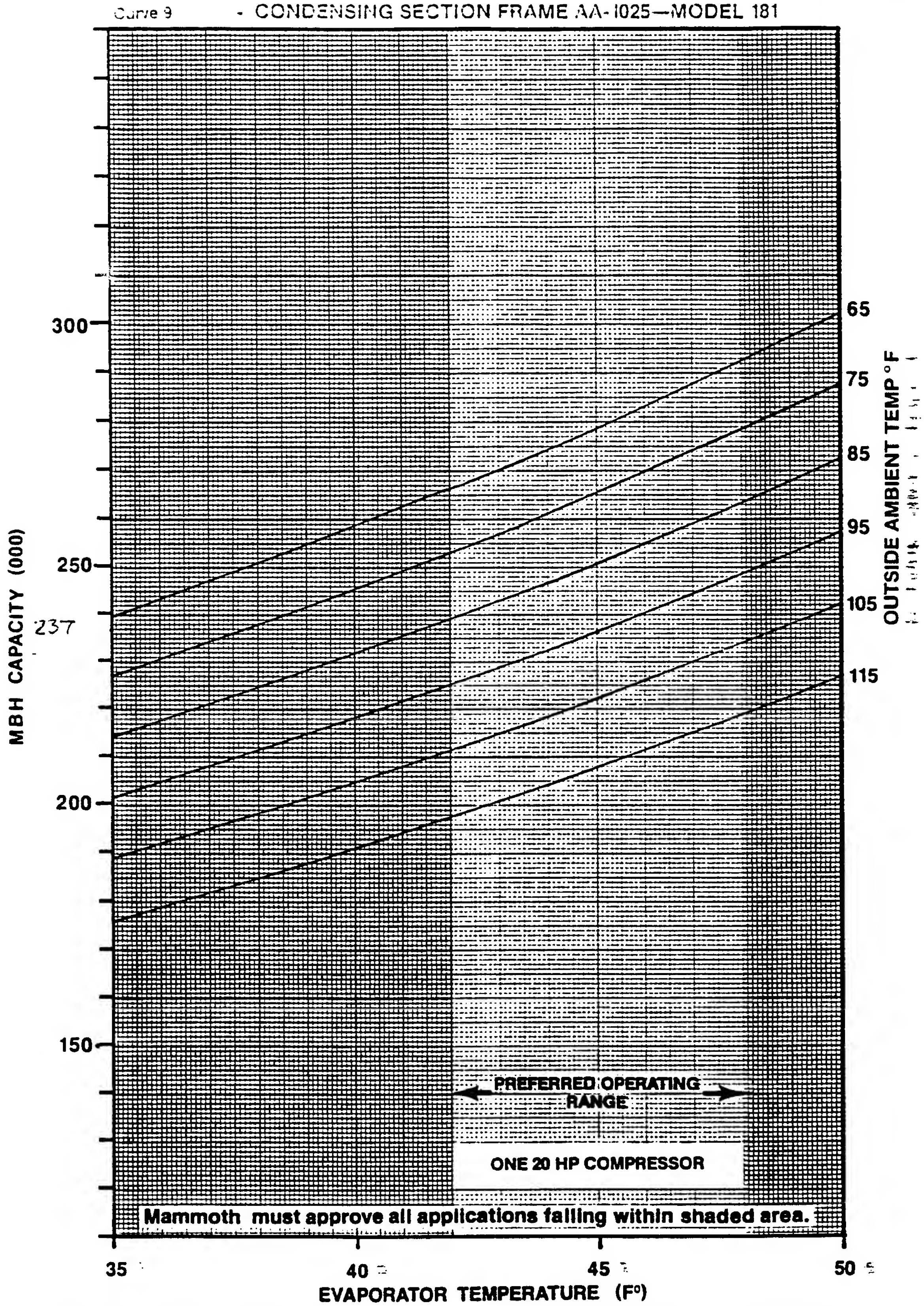
***Based on a maximum evaporator face velocity of 625 FPM.

**Blower horsepower based on CEHB unit with nominal evaporator DX coil, electric heat, 2" throwaway filters and 0.50" E.S.P.

*KW based on total system operating point at C.F.M. and total capacity listed in this table and at the conditions stated.

Ⓐ ~~Actual condenser fan horsepower is less than the indicated fan motor horsepower.~~

Curve 9 - CONDENSING SECTION FRAME AA-1025—MODEL 181



For VAV MZ or 100% outside air applications select high evap. temp. at design conditions.

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ECO 8-8

Table 29 **FRAME 1025—CONDENSER ELECTRIC DATA**

ELECTRICAL		MODEL 111	112	151	162	181	201	202	251
208v	Compressors FLA #1	41.1	20.4	60.3	31.7	70.9	87.9	41.1	104
	#2		20.4		31.7			41.1	
	LRA #1	208	141	284	145	308	428	208	470
	#2		141		145			208	
	Condenser Fans FLA (ea.)	5.8	5.8	7.5	7.5	7.5	10.6	10.6	10.6
	LRA (ea.)	33.2	33.2	43.1	43.1	43.1	59.7	59.7	59.7
	Total FLA	46.9	46.6	67.8	70.9	78.4	98.5	92.8	114.6
230v	Compressors FLA #1	37.2	18.5	54.5	28.7	64.1	79.5	37.2	94
	#2		18.5		28.7			37.2	
	LRA #1	208	141	284	145	308	428	208	470
	#2		141		145			208	
	Condenser Fans FLA (ea.)	5.2	5.2	6.8	6.8	6.8	9.6	9.6	9.6
	LRA (ea.)	30	30	39	39	39	54	54	54
	Total FLA	42.4	42.2	61.3	64.2	70.9	89.1	84.0	103.6
460v	Compressors FLA #1	18.5	9.2	25	14.3	32.1	39.7	18.5	47
	#2		9.2		14.3			18.5	
	LRA #1	104	62.5	144	72.5	154	214	104	235
	#2		62.5		72.5			104	
	Condenser Fans FLA (ea.)	2.6	2.6	3.4	3.4	3.4	4.8	4.8	4.8
	LRA (ea.)	15	15	19.8	19.8	19.8	27	27	27
	Total FLA	21.1	21.0	28.4	32.0	35.5	44.5	41.8	51.8
575v	Compressors FLA #1	14.7	7.4	20	11.5	25.6	31.8	14.7	37.6
	#2		7.4		11.5			14.7	
	LRA #1	88.2	53.4	127	58	135	160	88.2	200
	#2		53.4		58			88.2	
	Condenser Fans FLA (ea.)	2.1	2.1	2.7	2.7	2.7	3.9	3.9	3.9
	LRA (ea.)	12	12	15.6	15.6	15.6	24	24	24
	Total FLA	16.8	16.9	22.7	25.7	28.3	35.7	33.3	41.5

Table 30 **FRAME 2060—CONDENSER ELECTRIC DATA**

ELECTRICAL		MODEL 221	222	261	262	301	302	351	352	452	502	602
208v	Compressors FLA #1	87.9	41.1	104	41.1	133.3	60.3	150.4	70.9	87.9	104	133.3
	#2		41.1		60.3		60.3		70.9	87.9	104	133.3
	LRA #1	428	208	470	208	565	284	625	308	428	470	565
	#2		208		284		284		308	428	470	565
	Condenser Fans FLA (ea.)	5.8	5.8	5.8	5.8	7.5	5.8	7.5	7.5	10.6	10.6	16.8
	LRA (ea.)	33.2	33.2	33.2	33.2	43.1	33.2	43.1	43.1	59.7	59.7	99.5
	Total FLA	99.5	93.8	115.6	113.0	148.3	132.2	165.4	156.8	197.0	229.2	300.2
230v	Compressors FLA #1	79.5	37.2	94	37.2	120.5	54.5	136	64.1	79.5	94	120.5
	#2		37.2		54.5		54.5		64.1	79.5	94	120.5
	LRA #1	428	208	470	208	565	284	594	308	428	470	565
	#2		208		284		284		308	428	470	565
	Condenser Fans FLA (ea.)	5.2	5.2	5.2	5.2	6.8	5.2	6.8	6.8	9.6	9.6	15.2
	LRA (ea.)	30	30	30	30	39	30	39	39	54	54	90
	Total FLA	89.9	84.8	104.4	102.1	134.1	119.4	149.6	141.8	178.2	207.2	271.4
460v	Compressors FLA #1	39.7	18.5	47	18.5	60.3	25	68	32.1	39.7	47	60.3
	#2		18.5		25		25		32.1	39.7	47	60.3
	LRA #1	214	104	235	104	283	144	297	154	214	235	283
	#2		104		144		144		154	214	235	283
	Condenser Fans FLA (ea.)	2.6	2.6	2.6	2.6	3.4	2.6	3.4	3.4	4.8	4.8	7.6
	LRA (ea.)	15	15	15	15	19.8	15	19.8	19.8	27	27	45
	Total FLA	44.9	42.2	52.2	48.7	67.1	55.2	74.8	71.0	89.0	103.6	135.8
575v	Compressors FLA #1	31.8	14.7	37.6	14.7	48.2	20	54.4	25.6	31.8	37.6	48.2
	#2		14.7		20		20		25.6	31.8	37.6	48.2
	LRA #1	160	88.2	200	88.2	230	127	225	135	160	200	230
	#2		88.2		127		127		135	160	200	230
	Condenser Fans FLA (ea.)	2.1	2.1	2.1	2.1	2.7	2.1	2.7	2.7	3.9	3.9	6.1
	LRA (ea.)	12	12	12	12	15.6	12	15.6	15.6	24	24	36
	Total FLA	36.0	33.6	41.8	38.9	53.6	44.2	59.8	56.6	71.4	83.0	108.6

Table 31 **BLOWER MOTOR ELECTRIC DATA**

BLOWER MOTORS ELECTRICAL		HORSE POWER 3/4	1	1-1/2	2	3	5	7-1/2	10	15	20	25
208v	FLA	3.1	4.0	5.8	7.5	10.6	16.8	24.3	31.0	46.4	59.7	75.2
	LRA	18.6	23.2	33.2	43.1	59.7	99.5	146.0	179.1	265.4	345.0	424.6
230v	FLA	2.8	3.6	5.2	6.8	9.6	15.2	22	28	42	54	68
	LRA	16.8	21	30	39	54	90	132	162	240	312	384
460v	FLA	1.4	1.8	2.6	3.4	4.8	7.6	11	14	21	27	34
	LRA	8.4	10.8	15	19.8	27	45	66	84	120	156	192
575v	FLA	1.1	1.4	2.1	2.7	3.9	6.1	9	11	17	22	27
	LRA	6.6	8.4	12	15.6	24	36	54	66	96	126	156

NOTE: FULL LOAD AMPERES (FLA) AND LOCKED ROTOR AMPERES (LRA) VALUES ARE PER THE NATIONAL ELECTRIC CODE. ACTUAL PRODUCTION UNITS MAY DIFFER SLIGHTLY FROM THE ABOVE DUE TO MOTOR MANUFACTURER'S NAMEPLATE DATA.

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO # B-9
RECOVER WASTE-HEAT

PROJECT FHL EEAP
16-403-10
SHEET NO. 1 OF SHEETS

DESCRIPTION OF WORK

TWO FORMS OF WASTE-HEAT RECOVERY WERE EVALUATED FOR THIS OPPORTUNITY.
THE FIRST OPPORTUNITY CONSIDERED WAS HEAT RECOVERY FROM FLUE GASSES
THE SECOND OPPORTUNITY CONSIDERED WAS HEAT RECOVERY FROM AIR CONDITIONING EQUIPMENT.

1.) FLUE GAS HEAT RECOVERY

HOT FLUE GASSES FROM FIRED EQUIPMENT CONTAIN RECOVERABLE HEAT. HEAT EXCHANGERS CAN BE INSTALLED ON FLUES TO PREHEAT FEED WATER OR DOMESTIC HOT WATER MAKE-UP. HEAT CAN BE RECOVERED UP TO THE POINT WHERE THE FLUE GAS TEMPERATURE REACHES ITS DEWPOINT.

TWO TYPES OF RETROFITS WERE EVALUATED.
LARGER BOILERS (LARGER THAN BTU/HR) WERE EVALUATED FOR RETROFITTING WITH ENGINEERED, COMMERCIALLY AVAILABLE ECONOMIZERS

SMALLER BOILERS WERE NOT CONSIDERED FEASIBLE FOR THIS RETROFIT BECAUSE OF UNAVAILABILITY OF "OF-THE-SHELF" ECONOMIZERS AND THE COST OF FIELD FABRICATED UNITS

2.) A/C UNIT HEAT RECOVERY

AIR CONDITIONING SYSTEMS FEATURING A SPLIT EVAPORATOR AND CONDENSER FUNCTIONS WERE CONSIDERED FOR THE INSTALLATION OF A DOMESTIC HOT WATER MAKE-UP PREHEATER.

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS CHECKED BY DATE FEBRUARY 1993 REV. 19	ECO #B-9 RECOVER A/C SYSTEMS WASTE HEAT FOR DHW	PROJECT FHL EEAP 16-403-10 SHEET NO. 2 OF SHEETS

DESCRIPTION OF WORK – CONTINUED

HEAT REJECTED BY AIR CONDITIONING CONDENSERS IS POSSIBLE TO RECOVER TO ASSIST IN PREHEATING THE COLD WATER MAKE-UP TO THE DOMESTIC HOT WATER SYSTEM.

THIS OPPORTUNITY INVOLVES THE INSTALLATION OF A REFRIGERANT TO DHW HEAT EXCHANGER IN PARALLEL WITH THE EXISTING A/C UNIT'S AIR OR WATER COOLED CONDENSER.

PLUMBING CODES REQUIRE THAT THE HEAT EXCHANGER BE DOUBLE-WALLED TO PREVENT CONTAMINATION OF THE DOMISTIC WATER SUPPLY.

CONTROLS FOR THIS SYSTEM ARE MINIMAL SINCE THE REFRIGERANT WILL SEEK THE HEAT EXCHANGER MOST ABLE TO CONDENSE THE REFRIGERANT.

THE CONDENSER MOST ABLE TO COOL THE REFRIGERANT WILL HAVE A LOWER PRESSURE AS MORE GAS CONDENSES TO LIQUID, THUS AUTOMATICALLY DRAWING MORE HOT REFRIGERANT GAS TO THAT CONDENSER.

SEE THE FOLLOWING PAGE FOR A DIAGRAM OF THE HEAT RECLAIM SYSTEM.

FORM 101-1/8

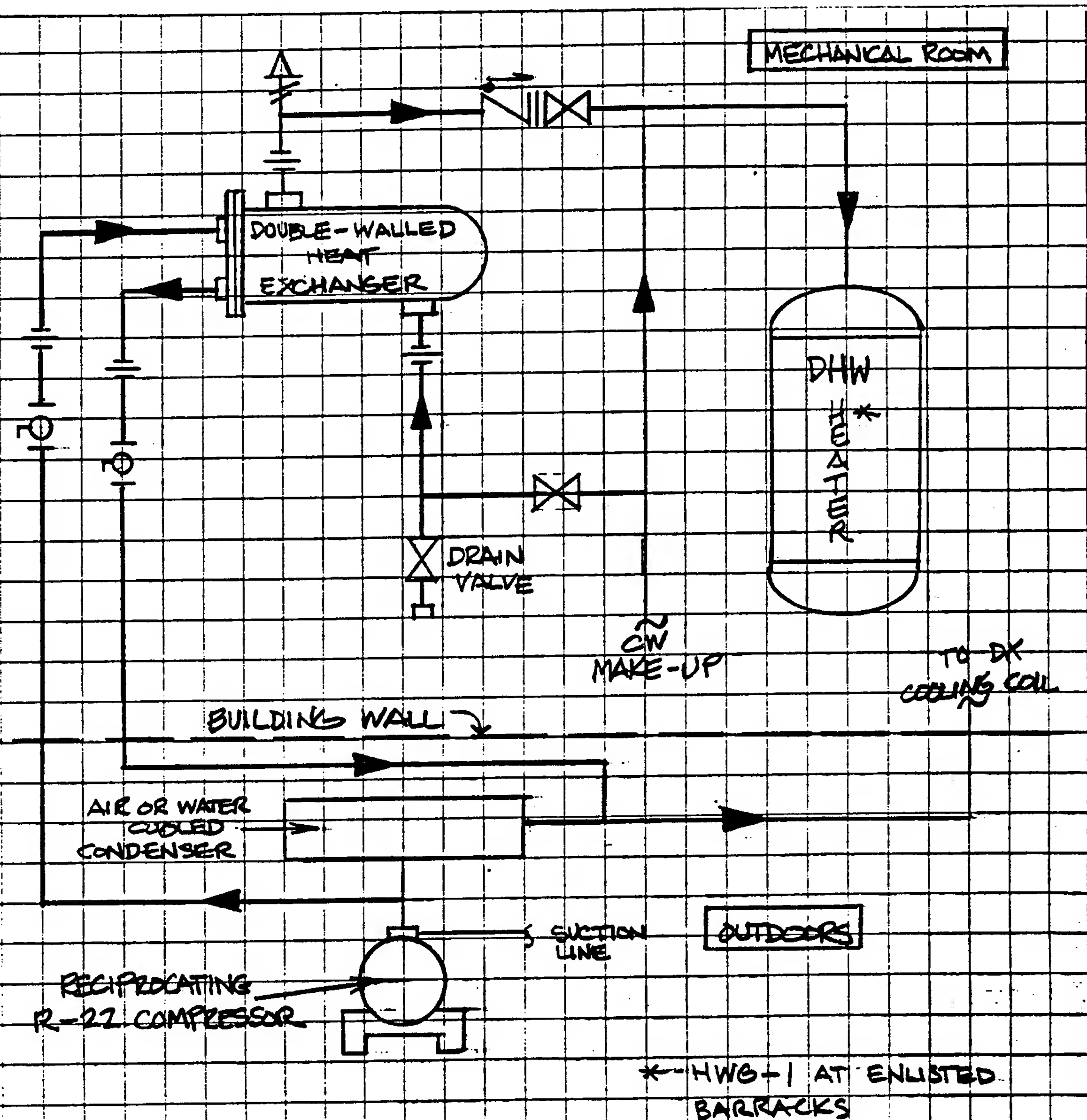
Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY
DATE 19__
REV. 19__

ECO # B9
RECOVER A/C SYSTEMS
WASTE HEAT FOR DHW

PROJECT FHL EEAP
16-403-10
SHEET NO. 3 OF ____ SHEETS



SCHEMATIC OF DHW HEAT RECLAIM SYSTEM
UTILIZING A/C EQUIPMENT WASTE HEAT

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO #B9
RECLAIM WASTE HEAT

PROJECT FHL EEAP 16-403-10

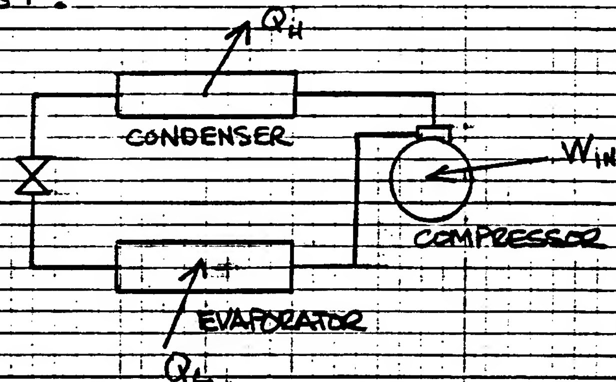
SHEET NO. 4 OF SHEETS

EVALUATION SUMMARY / APPROACH –

DOUBLE-WALLED HEAT EXCHANGERS, BECAUSE OF THEIR INTRICATE COMPOSITION AND THE NEED TO SIZE THEM LARGER THAN SINGLE-WALLED UNIT, WILL COST ON THE ORDER OF 3 TIMES THE COST OF A STANDARD EXCHANGER.

SINCE THIS OPPORTUNITY HAS A HIGH INVESTMENT COST SYSTEMS WILL SMALL ANNUAL DHW CONSUMPTIONS, SUCH AS FAMILY HOUSING UNITS, WERE REMOVED FROM CONSIDERATION.

THE HEAT AVAILABLE FOR RECLAIMATION WAS FOUND BY:



SIMPLIFIED REFRIGERATION CYCLE

BY THE FIRST LAW OF THERMODYNAMICS

$$Q_H = Q_L + W_{IN}$$

TOTAL HEAT REJECTION AT PEAK — DX COIL LOAD AT PEAK — COMPRESSOR WORK AT PEAK

ASSUME HEAT FROM W_{IN} IS UNAVAILABLE

ASSUME AVERAGE LOAD IS 0.25 X PEAK LOAD.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO # B9
RECOVER WASTE HEAT

PROJECT FHL EEAP
16-403-10

SHEET NO. 5 OF ___ SHEETS

EVALUATION SUMMARY / APPROACH - CONTINUED

ASSUME DHW TEMPERATURE LEAVING HEAT EXCHANGER CAN ONLY APPROACH 70% OF THE REFRIGERANT'S CONDENSING TEMPERATURE.

THE HIGH-CAPACITY, HIGH CONSUMPTION SYSTEMS OF THE ENLISTED BARRACKS WERE CHOSEN FOR FIRST CONSIDERATION SINCE THESE SYSTEMS ARE THE MOST LIKELY TO BE ECONOMICALLY FEASIBLE. THUS IF THESE SYSTEMS DID NOT HAVE ATTRACTIVE PAYBACK PERIODS & INTEREST RATES THEN CERTAINLY THE SMALLER SYSTEMS WITH LOWER DHW CONSUMPTIONS WOULD BE EVEN LESS DESIRABLE TO RETROFIT.

FOR BUILDING 207 TYPICAL FOR ENLISTED BARRACKS:

$$\text{ENERGY SAVED PER YEAR} \; \frac{\text{MIL BTU}}{\text{YR}} = \text{\# OF PEOPLE} \times \frac{\text{GAL}}{\text{CAP}\cdot\text{DAY}} \times \frac{\text{COOLING HRS}}{\text{YR}} \times \frac{1\ \text{DAY}}{24\ \text{HRS}} \times \frac{1\ \text{Btu}}{{}^\circ\text{F}\cdot\text{lb}} \times \frac{8.35\ \text{lb}}{\text{GAL}} \times \frac{\Delta T}{70\%}$$

$$= 100 \times 15 \times 1153 \times \frac{1}{24} \times 8.35 \times (90-55) \times \frac{1}{1\times10^6} \times \frac{1}{70\%}$$

$$= 30 \text{ MIL BTU/YR}$$

IF FUEL OIL IS THE FUEL USED THEN

$$30 \text{ MIL BTU/YR} \times 4.98 \text{ \$/MIL BTU} = \$150\text{/YR}$$

@ A ROUNDED CONSTRUCTION COST OF $12,000

THE SIMPLE PAYBACK IS: 80 YRS

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet Of

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO-B9 A/C Equip. Heat Reclaim

Estimator:

Checked By:

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Double-Walled Heat Exchanger	1	EA	-	$200	-	$5,000	$5,200
1 1/8" cu tubing/Insulation	90	LF	$3	$250	$3	$248	$498
3/4" cu tubing/Insulation	90	LF	$2	$180	$2	$180	$360
2" Black Steel Pipe	40	LF	$4	$140	$6	$244	$384
Cu Fittings	1	LS	-	$50	-	$25	$75
Steel Fittings	1	LS	-	$500	-	$250	$750
Hangers/Supports	1	LS	-	$200	-	$200	$400
Subtotal							$7,667
Sales Tax @ 8%							$613
Subtotal							$8,280
Contractor OH & Profit @ 30%							$2,484
Subtotal							$10,764
Bond @ 1%							$108
Subtotal							$10,871
Estimating Contingency @ 10%							$1,087
Total Probable Construction Cost							$11,959

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: ECO-B9 A/C Equip. Heat Reclaim   Fiscal Year FY96
Discrete Portion Name: Building 205
Analysis Date: March 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$12,000		
B. SIOH	$660		
C. Design Cost	$0		
D. Total Cost (1A+1B+1C)	$12,660		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$12,660

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0	$0	11.70	$0
B. Dist	$4.98	30	$149	13.78	$2,059
C. Propane	$7.87	0	$0	14.16	$0
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		30	$149		$2,059

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 84.9 Years
5. Total Net Discounted Savings (2F5+3C): $2,059
6. Savings to Investment Ratio (SIR) 5/1G: 0.16
7. Adjusted Internal Rate of Return (AIRR): -16%

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

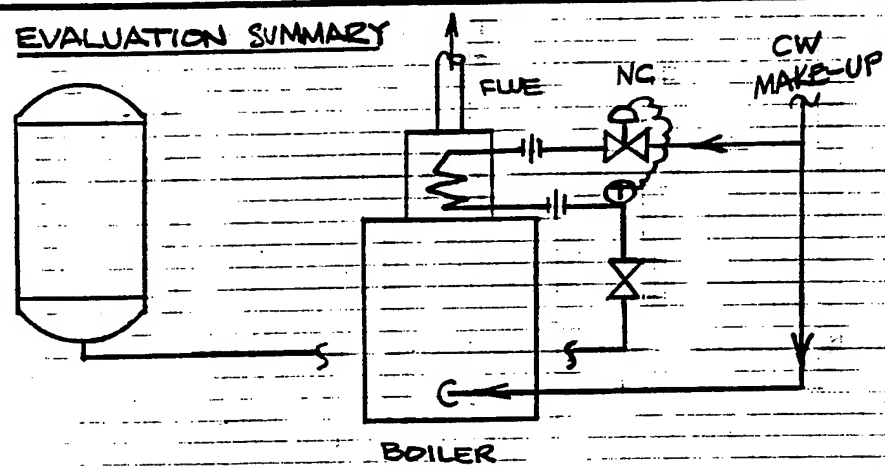
COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO #: B9
RECLAIM WASTE HEAT

PROJECT FHL EEAP
16-403-10

SHEET NO. ____ OF ____ SHEETS

EVALUATION SUMMARY



SCHEMATIC OF BOILER FEEDWATER PREHEATER UTILIZING FLUE-GAS WASTE HEAT

IF IMPLEMENTED, THE POTENTIAL COST SAVINGS WOULD BE:

HEAT RECLAIM COULD PRODUCE 140°F DHW TO MEET CONSUMPTION FOR PERIOD WHEN THE BOILER IS OPERATIONAL

ASSUME:

AVERAGE BOILER OUTPUT = $\frac{1}{4}$ x PEAK OUTPUT = $\frac{1}{4}$ x 1,875,000 = 468,750

CONSUMPTION = 15 GPCD x 90 PEOP = 1350 GAL/DAY

HEATING HOURS PER SEASON = 4,000 ÷ 4 = 1000

ENERGY SAVINGS = $\frac{HRS}{YR} \times \frac{GALS}{DAY} \times \frac{1\ DAY}{24\ HRS} \times (140-55) \times \frac{1\ Btu}{°F\text{-}lb} \times 8.35 \frac{lb}{gal} \times \frac{1}{1\times10^6} \times \frac{1}{\eta}$

$= 1000 \times 1350 \times \frac{1}{24} \times (140-55) \times 1 \times 8.35 \times \frac{1}{1\times10^6} \times \frac{1}{70\%}$

= 58 MIL Btu/YR

USING F.O. #2 SAVINGS PER YR = 58 x 4.98 = \$290/YR

PAYBAY PERIOD = 53.4 YRS

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet Of

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO-B9 Flue gas Heat Reclaim

Estimator:

Checked By:

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Boiler Economizer	1	LS	-	$2,500	-	$6,000	$8,500
2" Steel Pipe	30	LF	$8	$250	$4	$120	$370
Valve and Fittings	1	LS	-	$500	-	$500	$1,000
Subtotal							$9,870
Sales Tax @ 8%							$790
Subtotal							$10,660
Contractor OH & Profit @ 30%							$3,198
Subtotal							$13,857
Bond @ 1%							$139
Subtotal							$13,996
Estimating Contingency @ 10%							$1,400
Total Probable Construction Cost							$15,396

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO # B9
RECOVER WASTE HEAT

PROJECT FHL EEAP
16-403-10

SHEET NO. ____ OF ____ SHEETS

ORDER OF IMPLEMENTATION

BECAUSE OF THE HIGH CAPITAL FIRST COSTS INVOLVED IN THE PROJECTS CONSIDERED UNDER THIS OPTION THE ECONOMICS DO NOT FAVOR THE IMPLEMENTATION OF THESE OPTIONS. THESE OPPORTUNITIES WERE ASSUMED NOT TO BE IMPLEMENTED.

FORM 101-1/8

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California | Region No. 4 | Project No. 16-403-10
Project Title: ECO-B9 A/C Equip. Heat Reclaim | Fiscal Year FY96
Discrete Portion Name: Building 205
Analysis Date: March 1993 | Economic Life: 15 YEARS | Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$15,400		
B. SIOH	$847		
C. Design Cost	$0		
D. Total Cost (1A+1B+1C)	$16,247		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$16,247

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0	$0	11.70	$0
B. Dist	$4.98	58	$289	13.78	$3,980
C. Propane	$7.87	0	$0	14.16	$0
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		58	$289		$3,980

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur.(2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 56.2 Years
5. Total Net Discounted Savings (2F5+3C): $3,980
6. Savings to Investment Ratio (SIR) 5/1G: 0.24
7. Adjusted Internal Rate of Return (AIRR): -13%

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY BH
DATE FEBRUARY 1993
REV. 19__

ECO # B10
AUTOMATIC BOILER FLUE DAMPERS ON HVAC - HW BOILERS

PROJECT FHL EEAP 16-403-10
SHEET NO. 1 OF 8 SHEETS

DESCRIPTION OF WORK

THE OPPORTUNITY LOOKS AT THE POTENTIAL ENERGY SAVINGS CREATED BY THE INSTALLATION OF A DAMPER WHICH CLOSES OFF THE FLUE WHEN THE BOILER IS RUNNING IN STANDBY MODE.

ABOUT 2-3% OF THE BOILERS CAPACITY THROUGH LOSSES THROUGH THE FLUE UNDER STANDBY CONDITIONS.

BUILDINGS INCLUDED

SEE ATTACHED PRINT-OUTS

ENERGY SAVINGS CALCULATIONS

ENERGY SAVINGS ARE DETERMINED BY ASSUMING A 1.5% THERMAL EFFICIENCY IMPROVEMENT IN FIRED EQUIPMENT USED TO HEAT DHW. SAVINGS ARE CALCULATED AS FOLLOWS

$$Q_S = Q_0 - Q_0 * \eta_0 / (\eta_0 + 1.5\%)$$

WHERE: Q_S = FUEL SAVINGS

Q_0 = BASELINE (AFTER REDUCTION OF DHW TEMPS TO AUTH. LEVELS @ ECO C-1) FUEL USE

η_0 = BASELINE DHW HEATING EFFICIENCY

FORM 101-1/8

ECO B10
Sheet 2 of 8

Fac No.	Installation Name	ECO B10 Incl	ECO B10 Energy Savings: Automatic Flue Dampers Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Yr	Propane $/Yr	Fuel Oil $/Yr	LCC $ Saved	Constr Cost	Investment	Payback Years	SIR
T 6	Family Housing NCO & Enl	1	-	1.0	-	-	$7.70	-	$109	$531	$592	76.94	0.18
P 41A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 41B	Family Housing NCO & Enl												
P 42A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 42B	Family Housing NCO & Enl												
P 43A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 43B	Family Housing NCO & Enl												
P 44A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 44B	Family Housing NCO & Enl												
P 45A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 45B	Family Housing NCO & Enl												
P 46	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 47	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 51A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 51B	Family Housing NCO & Enl												
P 52A	Family Housing NCO & Enl		-	-	-	-	-	-	-	-	-	-	-
P 52B	Family Housing NCO & Enl												
P 53	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 54	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 55	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 56	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 57	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 58	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 59	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
P 60	Family Housing CG & WO		-	-	-	-	-	-	-	-	-	-	-
S 79	Post Office, Main		-	-	-	-	-	-	-	-	-	-	-
P 80	Exchange, Main Retail	1	-	1.2	-	-	$9.41	-	$133	$541	$603	64.07	0.22
P 81	Theater with Dressing Rm's		-	-	-	-	-	-	-	-	-	-	-
P 101	Open Din Cons (Hacienda) Club (Bar) Hacienda, East Rooms Hacienda, West Rooms	1	-	23.5	-	-	$184.99	-	$2,619	$1,136	$1,267	6.85	2.07
P 116	Exchange Service Station (Non-shop areas)		-	-	-	-	-	-	-	-	-	-	-
T 120	Fire Station - Office Fire Station - Dorm Fire Station - Garage	1	-	15.7	-	-	$123.44	-	$1,748	$1,082	$1,206	9.77	1.45

ECO B10
Sheet 3 of 8

Fac No.	Installation Name	ECO B10 Incl	ECO B10 Energy Savings: Automatic Flue Dampers Electric KWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Yr	Propane $/Yr	Fuel Oil $/Yr	LCC $ Saved	Constr Cost	Investment	Payback Years	SIR
T 121	Bowling Center	1	-	1.1	-	-	$8.48	-	$120	$568	$633	74.66	0.19
T 124	Family Housing LC & MJ		-	-	-	-	-	-	-	-	-	-	-
T 127	Officers Quarters Military	1	-	4.4	-	-	$34.81	-	$493	$541	$603	17.33	0.82
P 128	Officers Quarters Military	1	-	13.1	-	-	$102.99	-	$1,458	$568	$633	6.15	2.30
T 131	Family Housing CG & WO	1	-	0.9	-	-	$7.04	-	$100	$531	$592	84.10	0.17
S 144	Gymnasium		-	-	-	-	-	-	-	-	-	-	-
S 146	FE Facility		-	-	-	-	-	-	-	-	-	-	-
T 149	Family Housing NCO & Enl	1	-	2.5	-	-	$19.47	-	$276	$531	$592	30.42	0.47
T 156	FE Facility - Shop FE Facility - Office		-	-	-	-	-	-	-	-	-	-	-
T 158	Vehicle Storage		-	-	-	-	-	-	-	-	-	-	-
T 161	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
T 162	Elec Maint. Shop		-	-	-	-	-	-	-	-	-	-	-
T 163	Officers Quarters Military		-	-	-	-	-	-	-	-	-	-	-
T 164	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
T 165	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
T 166	Officers Quarters Military		-	-	-	-	-	-	-	-	-	-	-
T 167	Officers Quarters Military		-	-	-	-	-	-	-	-	-	-	-
S 168	General Purp Warehouse		-	-	-	-	-	-	-	-	-	-	-
T 172	Cold Storage Warehouse		-	-	-	-	-	-	-	-	-	-	-
P 177	Technical Library		-	-	-	-	-	-	-	-	-	-	-
P 178	Child Development Cntr		-	-	-	-	-	-	-	-	-	-	-
S 182	Commissary		-	-	-	-	-	-	-	-	-	-	-
S 186	Sup Svc Admin Bldg		-	-	-	-	-	-	-	-	-	-	-
P 190	Post Chapel		-	-	-	-	-	-	-	-	-	-	-
S 197	Admin Bldg R&D - Office Admin Bldg R&D - Electronics	1	-	5.7	-	-	$44.87	-	$635	$541	$603	13.44	1.05
S 198	General Inst Bldg	1	-	1.1	-	-	$8.33	-	$118	$541	$603	72.37	0.20
P 205 P 205A	Admin General Purpose Company HQ Building	1	-	-	28.2	-	-	$140.25	$1,933	$582	$649	4.63	2.98
P 206	Enlisted Pers Dining Fac Kitchen Area - Scullery	1	-	-	81.8	-	-	$407.38	$5,614	$1,164	$1,298	3.19	4.33
P 207 P 207A	Enl Barracks w/o Dining Company HQ Building	1	-	-	28.3	-	-	$140.90	$1,942	$582	$649	4.61	2.99
P 208 P 208A	Enl Barracks w/o Dining Company HQ Building	1	-	-	28.0	-	-	$139.49	$1,922	$582	$649	4.65	2.96

ECO B10
Sheet 4 of 8

Fac No.	Installation Name	ECO B10 Incl	ECO B10 Energy Savings: Automatic Flue Dampers Electric kWH/Yr	Propane Mil BTU/Yr	Fuel Oil Mil BTU/Yr	Electric $/Yr	Propane $/Yr	Fuel Oil $/Yr	LCC $ Saved	Constr Cost	Investment	Payback Years	SIR
P 209	AAFES Snack Bar	1	-	2.0	-	-	$15.97	-	$226	$541	$603	37.78	0.37
P 210	Hlth/Dntl Clinic w/ Beds	1	-	-	21.5	-	-	$106.94	$1,474	$582	$649	6.07	2.27
P 211	Outdoor Swimming Pool	1	-	27.2	-	-	$214.28	-	$3,034	$568	$633	2.96	4.79
P 212	Gymnasium	1	-	16.5	-	-	$129.83	-	$1,838	$541	$603	4.65	3.05
P 219	Physical Fitness Center	1	-	9.4	-	-	$74.16	-	$1,050	$568	$633	8.54	1.66
P 229 P 229A	Enl Barracks w/o Dining Company HQ Building	1	-	-	28.1	-	-	$139.87	$1,927	$582	$649	4.64	2.97
P 230 P 230A	Enl Barracks w/o Dining Company HQ Building	1	-	-	28.4	-	-	$141.35	$1,948	$582	$649	4.59	3.00
S 235	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 236	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 237	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 238	Sig Photo Lab Process	1	-	10.8	-	-	$85.17	-	$1,206	$531	$592	6.95	2.04
P 240	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 241	GM Facility	1	-	3.4	-	-	$26.54	-	$376	$541	$603	22.73	0.62
S 243	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 244	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 246	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
S 247	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
P 252	Vehicle Maint Shop DS	1	-	-	18.5	-	-	$92.11	$1,269	$582	$649	7.05	1.96
P 256	Vehicle Maint Shop ORG	1	-	-	8.3	-	-	$41.14	$567	$576	$642	15.61	0.88
P 259	Vehicle Maint Shop ORG	1	-	-	20.1	-	-	$100.11	$1,379	$582	$649	6.48	2.13
S 283	FE Maintenance Shop		-	-	-	-	-	-	-	-	-	-	-
S 286	Admin General Purpose		-	-	-	-	-	-	-	-	-	-	-
P 287	Recreation Building	1	-	3.0	-	-	$23.74	-	$336	$541	$603	25.41	0.56
S 288	General Purpose Warehouse		-	-	-	-	-	-	-	-	-	-	-
S 290	Electron Equip Facility	1	-	17.4	-	-	$137.19	-	$1,943	$568	$633	4.62	3.07
S 291	Cont Humid Warehouse	1	-	9.4	-	-	$74.03	-	$1,048	$568	$633	8.55	1.66
P 295	Enl Barracks w/o Dining	1	-	25.5	-	-	$200.71	-	$2,842	$568	$633	3.16	4.49
P 301	ADP Building	1	-	0.7	-	-	$5.58	-	$79	$541	$603	108.15	0.13

ECO B10
Sheet 5 of 8

Fac No.	Installation Name	ECO B10 Incl	Electric kWH/Yr	Propane Mil BTU/Y	Fuel Oil Mil BTU/Y	Electric $/Yr	Propane $/Yr	Fuel Oil $/Yr	LCC $ Saved	Constr Cost	Investment	Payback Years	SIR
			ECO B10 Energy Savings: Automatic Flue Dampers										
P 642	Detached Latrine/Shower		-	-	-	-	-	-	-	-	-	-	-
S 2201	Control Tower - Range SPT		-	-	-	-	-	-	-	-	-	-	-
Totals			0	174.3	282.8	$0	$1,372	$1,408	$38,830	$13,059	14,560.8	5.24	2.67
		Totals are for buildongs with SIR's > 1.0 ONLY											

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 6 OF 8
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-B10 Install Automatic Flue Dampers on	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
OIL FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	$32	$156	$156	$188
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 4-inch Flue, Oil Fired							$368
Sales Tax 8%							$29
Contractor O.H. & P 30%							$29
Sub Total							$426
Bond 1%							$4
Sub Total							$431
Estimating Contingency 10%							$43
Total Probable Construction Cost							$474
6-inch Diameter Auto-Damper	1	Ea	34.90	$35	$161	$161	$196
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 6-inch Flue, Oil Fired							$376
Sales Tax 8%							$30
Contractor O.H. & P 30%							$113
Sub Total							$519
Bond 1%							$5
Sub Total							$524
Estimating Contingency 10%							$52
Total Probable Construction Cost							$576
8-inch Diameter Auto-Damper	1	Ea	38.40	$38	$161	$161	$199
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 8-inch Flue, Oil Fired							$379
Sales Tax 8%							$30
Contractor O.H. & P 30%							$114
Sub Total							$524
Bond 1%							$5
Sub Total							$529
Estimating Contingency 10%							$53
Total Probable Construction Cost							$582

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 7 OF 8

Project: EEAP Limited Energy Study

Project No.: 16-403-10

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO-B10 Install Automatic Flue Dampers on

Estimator: RJB

Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
GAS FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	$32	$134	$134	$166
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 4-inch Flue, Gas Fired							$346
Sales Tax 8%							$28
Contractor O.H. & P 30%							$104
Sub Total							$478
Bond 1%							$5
Sub Total							$483
Estimating Contingency 10%							$48
Total Probable Construction Cost							$531
6-inch Diameter Auto-Damper	1	Ea	34.90	$35	$138	$138	$173
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 6-inch Flue, Gas Fired							$353
Sales Tax 8%							$28
Contractor O.H. & P 30%							$106
Sub Total							$487
Bond 1%							$5
Sub Total							$492
Estimating Contingency 10%							$49
Total Probable Construction Cost							$541
8-inch Diameter Auto-Damper	1	Ea	38.40	$38	$152	$152	$190
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 8-inch Flue, Gas Fired							$370
Sales Tax 8%							$30
Contractor O.H. & P 30%							$111
Sub Total							$511
Bond 1%							$5
Sub Total							$516
Estimating Contingency 10%							$52
Total Probable Construction Cost							$568

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: Automatic Flue Dampers on HVAC HW Boilers   Fiscal Year FY96
Discrete Portion Name: ECO# B-10
Analysis Date: March 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$13,059		
B. SIOH	$718		
C. Design Cost	$784		
D. Total Cost (1A+1B+1C)	$14,561		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$14,561

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	0.0	$0	11.70	$0
B. Dist	$4.98	282.2	$1,405	13.78	$19,366
C. Propane	$7.87	174.3	$1,372	14.16	$19,424
D. Demand	$108.60	0.0 kw	$0	11.70	$0
E. Other					
F. Total			$2,777		$38,790

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):   5.2 Years
5. Total Net Discounted Savings (2F5+3C): $38,790
6. Savings to Investment Ratio (SIR) 5/1G: 2.66
7. Adjusted Internal Rate of Return (AIRR):

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY DJH
DATE FEB 1993
REV. 19__

ECO # B-11
ECONOMIZER
PROJECT DESCRIPTION

PROJECT 16-403-10
FTL EEAP
SHEET NO. 1 OF 16 SHEETS

DESCRIPTION OF ACTION:

BUILDINGS WITH CENTRAL UNIT AIR CONDITIONING WILL BE EQUIPPED WITH ECONOMIZER CONTROLS TO TAKE ADVANTAGE OF FREE COOLING IF THE OUTSIDE AIR TEMPERATURE IS LOW ENOUGH TO CONDITION THE SPACE WITHOUT ADDITIONAL COOLING. THIS WILL INVOLVE ADDITIONAL DUCTWORK, DAMPERS AND MODULATORS AS WELL AS EXTERIOR WALL PENETRATIONS IN SOME CASES.

FACILITIES INCLUDED:

120	186	290 *
121 *	190	291 *
161	197	
162	209	
177 *	240	
178	241 *	

* INCLUDED TRACE 600 ANALYSIS

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BJH
DATE FEB 1993
REV. 19

ECO # B-11
ECONOMIZER
TRACE 600 ASSUMPTIONS

PROJECT 16-403-10
FHL EEAP
SHEET NO. 2 OF 16 SHEETS

BUILDING	DESCRIPTION OF MODEL
121	THE LARGE, PACKAGED OUTDOOR ELECTRIC COOLING/GAS HEATING UNIT IS EQUIPPED WITH ECONOMIZER CONTROLS TO SUPPLY 100% UNCONDITIONED OUTDOOR AIR WHEN THE SPACE CALLS FOR COOLING AND THE OUTSIDE AIR TEMPERATURE IS LESS THEN 68°F DB. THIS REDUCES THE AIR COOLED CONDENSER/COMPRESSOR USE.
177	SAME AS BLDG. 121
241	THE EXTERIOR OF THE MECHANICAL ROOM IS PENETRATED AND OUTSIDE AIR IS DUCTED TO THE CENTRAL MULTIZONE UNIT TO PROVIDE 100% UNCONDITIONED OUTSIDE AIR WHEN ALL ZONES REQUIRE COOLING AND THE OUTSIDE AIR IS BELOW 68°F DB THIS REDUCES THE CHILLER USEAGE.

101-1/8

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY BIH
DATE FEB 1983
REV. 19__

ECO# B-11
ECONOMIZER
TRACE 600 ASSUMPTIONS

PROJECT K-403-10
FHL EEAP
SHEET NO. 3 OF 16 SHEETS

BUILDING — DESCRIPTION OF MODEL

290 THE EXTERIOR OF THE MECHANICAL ROOM IS PENETRATED AND OUT SIDE AIR IS DUCTED TO THE CENTRAL SINGLE ZONE UNIT TO PROVIDE 100% UNCONDITIONED OUTSIDE AIR WHEN THE SPACE CALLS FOR COOLING AND THE OUTSIDE AIR TEMPERATURE IS LESS THEN 68°F BY REDUCING THE CHILLER DEMAND

291 THE EXTERIOR OF THE BUILDING IS PENETRATED AND OUT SIDE AIR IS DUCTED TO THE PACKAGED TERMINAL AIR CONDITIONER TO PROVIDE 100% UNCONDITIONED OUTSIDE AIR WHEN THE SPACE CALLS FOR COOLING AND THE OUTSIDE AIR TEMPERATURE IS LESS THEN 68°F BY REDUCING THE AIR COOLED CONDENSER/COMPRESSOR USE.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BHH
DATE FEB 1993
REV. 19

ECO # B-11
ECONOMIZER
ANNUAL O+M TRAINING $

PROJECT 16-403-10
THL EEAP
SHEET NO. 4 OF 16 SHEETS

ASSUME ANNUAL MAINTENANCE COSTS INCURRED FOR REPAIR AND RECALIBRATION OF AUTOMATIC DAMPERS AND CONTROLS:

(1) ELECTRICIAN @	\$40.10 /HR *
+ (1) SHEET METAL WORKER @	\$20.68/HR *
	\$60.78/HR

\$60.78/HR x 2 HR /BLDG x 14 BLDGS = \$1700/YR

\$1700/YR x 11.2 = \$19,000 **

* 1993 MEANS COST FOR WORKERS FROM CREWS G-3 + L-1

** UPW FACTOR FROM TABLE A OF 10/92 NISTIR 85-3273-X @ 4% IS 11.2 FOR 15 YR ESCALATION.

01-1/8

ECO B/1
Sheet 5 of 16

ECO: RETROFIT ECONOMIZERS ON EXISTING COOLING SYSTEMS

ENERGY SAVING CALCULATIONS FOR NON-TRACE 600 BUILDINGS

Cooling energy is saved by an economizer system by rejecting Return Air which is at a higher energy level (enthalpy) than the outside air. The outside air is conditioned and supplied to the space in place of the higher energy return air.

For the purposes of these calculations, dry bulb temperature is used to discriminate between outside air and return air. An economizer is assumed engaged whenever the outside air temperature is lower than that of the return air.

Most conditioned spaces are not authorized cooling when outside temperatures are below 78 Degrees F. (Fort Ord Regulation 11-2) However, systems are normally operated to provide space temperatures in the range of 72 to 75 Degrees F even though the minimum cooling temperature setpoint authorized is 78 Degrees F.

Since energy savings for an economizer occur when return air temperature exceeds outside air temperature, only buildings which require cooling during normally non-authorized periods are applicable to this ECO.

Assume return air temperature is 72 Degrees F.
Assume supply air temperature is 55 Degrees F.
Assume 1.5 CFM per floor SF air supply.
Assume 25% OA is introduced into the space.

Annual Hourly Temperatures, Averages per Month:

MONTH/HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	32.7	31.1	29.7	28.7	28.4	29.1	30.7	33.8	38.1	43.1	48.8	54.2	58.2	60.9	61.9	60.9	58.5	54.9	50.5	46.1	42.5	39.1	36.4	34.4
February	40.2	38.8	37.7	36.9	36.6	37.2	38.5	41.0	44.6	48.7	53.3	57.7	61.0	63.2	64.0	63.2	61.3	58.3	54.7	51.1	48.1	45.4	43.2	41.5
March	41.6	40.1	39.0	38.1	37.8	38.4	39.8	42.4	46.2	50.5	55.4	60.3	65.5	67.8	68.6	67.8	65.7	61.6	56.8	53.1	49.9	47.0	44.7	43.0
April	45.8	43.9	42.5	41.4	41.0	41.7	43.6	46.9	51.7	57.2	64.4	71.3	75.7	78.7	79.8	78.7	76.1	72.1	66.8	60.5	56.4	52.8	49.8	47.8
May	48.3	46.7	45.5	44.6	44.3	44.9	46.4	49.2	53.2	57.9	64.1	70.1	73.8	76.2	77.2	76.2	74.1	70.7	65.7	60.6	57.2	54.2	51.7	49.8
Jun	58.0	56.0	54.4	53.2	52.8	53.6	55.6	59.2	65.9	72.4	79.2	85.6	90.5	93.7	94.9	93.7	90.9	86.4	81.2	76.0	70.6	65.6	62.4	60.0
July	61.5	59.4	57.7	56.4	56.0	56.8	58.9	62.7	69.2	76.5	83.6	90.3	95.4	98.7	100.0	98.7	95.8	91.2	85.7	80.3	75.6	71.4	67.1	63.6
August	60.8	58.9	57.4	56.3	55.9	56.6	58.5	62.0	68.4	74.6	81.1	87.1	91.7	94.7	95.9	94.7	92.1	87.9	83.0	78.0	73.6	70.0	66.0	62.7
September	54.1	52.3	50.8	49.7	49.3	50.1	51.9	55.2	60.0	66.5	73.7	79.6	84.0	86.9	88.0	86.9	84.4	80.3	75.6	70.8	65.7	61.1	58.1	55.9
October	48.3	46.5	45.1	44.0	43.6	44.3	46.1	49.4	54.2	59.6	66.8	73.6	78.0	80.9	82.0	80.9	78.4	74.4	69.6	64.4	58.9	55.2	52.3	50.1
November	39.5	38.0	36.9	36.0	35.7	36.3	37.7	40.3	44.1	48.5	53.4	59.0	63.5	65.8	66.7	65.8	63.8	59.6	54.8	51.1	47.9	45.0	42.7	40.9
December	36.9	35.7	34.9	34.2	34.0	34.4	35.5	37.5	40.4	43.8	47.6	51.1	53.8	55.6	56.3	55.6	54.0	51.6	48.7	45.8	43.3	41.1	39.3	38.0

NO ECONOMIZER

Mixed Air Temperatures Entering Coil; 75% at 72 Degrees F and 25% OA:

January	62.2	61.8	61.4	61.2	61.1	61.3	61.7	62.5	63.5	64.8	66.2	67.6	68.6	69.2	69.5	69.2	68.6	67.7	66.6	65.5	64.6	63.8	63.1	62.6
February	64.1	63.7	63.4	63.2	63.2	63.3	63.6	64.3	65.2	66.2	67.3	68.4	69.3	69.8	70.0	69.8	69.3	68.6	67.7	66.8	66.0	65.4	64.8	64.4
March	64.4	64.0	63.8	63.5	63.5	63.6	64.0	64.6	65.6	66.6	67.9	69.1	70.4	71.0	71.2	71.0	70.4	69.4	68.2	67.3	66.5	65.8	65.2	64.8
April	65.5	65.0	64.6	64.4	64.3	64.4	64.9	65.7	66.9	68.3	70.1	71.8	72.9	73.7	74.0	73.7	73.0	72.0	70.7	69.1	68.1	67.2	66.5	65.9
May	66.1	65.7	65.4	65.2	65.1	65.2	65.6	66.3	67.3	68.5	70.0	71.5	72.5	73.1	73.3	73.1	72.5	71.7	70.4	69.2	68.3	67.6	66.9	66.5
Jun	68.5	68.0	67.6	67.3	67.2	67.4	67.9	68.8	70.5	72.1	73.8	75.4	76.6	77.4	77.7	77.4	76.7	75.6	74.3	73.0	71.7	70.4	69.6	69.0
July	69.4	68.9	68.4	68.1	68.0	68.2	68.7	69.7	71.3	73.1	74.9	76.6	77.9	78.7	79.0	78.7	78.0	76.8	75.4	74.1	72.9	71.9	70.8	69.9
August	69.2	68.7	68.4	68.1	68.0	68.2	68.6	69.5	71.1	72.7	74.3	75.8	76.9	77.7	78.0	77.7	77.0	76.0	74.8	73.5	72.5	71.5	70.5	69.7
September	67.5	67.1	66.7	66.4	66.3	66.5	67.0	67.8	69.0	70.6	72.4	73.9	75.0	75.7	76.0	75.7	75.1	74.1	72.9	71.7	70.4	69.3	68.5	68.0
October	66.1	65.6	65.3	65.0	64.9	65.1	65.5	66.4	67.6	68.9	70.7	72.4	73.5	74.2	74.5	74.2	73.6	72.6	71.4	70.1	68.7	67.8	67.1	66.5
November	63.9	63.5	63.2	63.0	62.9	63.1	63.4	64.1	65.0	66.1	67.4	68.8	69.9	70.5	70.7	70.5	70.0	68.9	67.7	66.8	66.0	65.3	64.7	64.2
December	63.2	62.9	62.7	62.6	62.5	62.6	62.9	63.4	64.1	65.0	65.9	66.8	67.5	67.9	68.1	67.9	67.5	66.9	66.2	65.5	64.8	64.3	63.8	63.5

ECO B11
Sheet 6 of 16

ECO B11
Sheet 7 of 16

ECONOMIZER ON

Mixed Air Temperatures Entering Coil; Minimum 55 Degrees F, coil leaving air temp

January	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	58.2	60.9	61.9	60.9	58.5	55.0	55.0	55.0	55.0	55.0	55.0	55.0
February	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	57.7	61.0	63.2	64.0	63.2	61.3	58.3	55.0	55.0	55.0	55.0	55.0	55.0
March	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.4	60.3	65.5	67.8	68.6	67.8	65.7	61.6	56.8	55.0	55.0	55.0	55.0	55.0
April	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	57.2	64.4	71.3	72.9	73.7	74.0	73.7	73.0	72.0	66.8	60.5	56.4	55.0	55.0	55.0
May	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	57.9	64.1	70.1	72.5	73.1	73.3	73.1	72.5	70.7	65.7	60.6	57.2	55.0	55.0	55.0
Jun	58.0	56.0	55.0	55.0	55.0	55.0	55.6	59.2	65.9	72.1	73.8	75.4	76.6	77.4	77.7	77.4	76.7	75.6	74.3	73.0	70.6	65.6	62.4	60.0
July	61.5	59.4	57.7	56.4	56.0	56.8	58.9	62.7	69.2	73.1	74.9	76.6	77.9	78.7	79.0	78.7	78.0	78.8	75.4	74.1	72.9	71.4	67.1	63.8
August	60.8	58.9	57.4	56.3	55.9	56.6	58.5	62.0	68.4	72.7	74.3	75.8	76.9	77.7	78.0	77.7	77.0	76.0	74.8	73.5	72.5	70.0	66.0	62.7
September	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.2	60.0	66.5	72.4	73.9	75.0	75.7	76.0	75.7	75.1	74.1	72.9	70.8	65.7	61.1	58.1	55.9
October	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	59.6	66.8	72.4	73.5	74.2	74.5	74.2	73.6	72.6	69.6	64.4	58.9	55.2	55.0	55.0
November	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	59.0	63.5	65.8	66.7	65.8	63.8	59.6	55.0	55.0	55.0	55.0	55.0	55.0
December	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.6	56.3	55.6	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0

NO ECONOMIZER

COOLING DEGREE HOURS FROM COIL ENTERING TEMPERATURE TO 55 Deg F.

January	222	210	199	191	189	195	207	231	264	303	347	389	420	441	449	441	422	394	360	326	298	272	251	236
February	253	244	236	230	228	232	242	259	284	313	345	376	399	414	420	414	401	380	355	330	309	290	274	263
March	291	280	271	264	262	267	277	298	327	360	398	436	477	494	501	494	478	446	409	381	356	333	315	302
April	314	299	289	280	278	283	297	322	358	399	453	505	538	560	569	560	541	511	471	424	393	366	344	327
May	343	331	322	315	312	317	329	350	381	418	466	512	541	560	567	560	543	517	478	439	412	389	370	355
Jun	405	390	378	369	366	372	387	414	464	513	564	612	649	673	682	673	652	618	579	540	500	462	438	420
July	446	429	416	406	403	409	425	455	505	562	617	669	708	734	744	734	711	676	633	591	555	522	489	462
August	440	425	414	405	402	408	422	450	499	547	598	644	680	703	712	703	683	650	612	574	541	512	481	455
September	376	362	351	343	340	346	359	384	420	469	523	567	600	622	630	622	603	572	537	501	463	428	406	389
October	343	329	319	310	307	312	326	352	389	431	487	539	574	596	605	596	577	546	508	468	425	397	374	357
November	266	255	247	240	238	242	253	272	301	334	370	413	446	464	470	464	449	417	381	353	329	308	290	277
December	255	246	239	234	233	236	244	260	282	308	338	365	386	400	405	400	388	369	346	324	305	288	274	264

ECONOMIZER ON

COOLING DEGREE HOURS FROM COIL ENTERING TEMPERATURE TO 55 Deg F.

January	0	0	0	0	0	0	0	0	0	0	0	0	99	183	214	183	109	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	76	168	230	252	230	176	92	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	12	164	326	397	422	397	332	205	56	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0	66	282	489	538	560	569	560	541	511	354	165	42	0	0	0
May	0	0	0	0	0	0	0	0	0	90	282	468	541	560	567	560	543	487	332	174	68	0	0	0
Jun	90	30	0	0	0	0	18	126	327	513	564	612	649	673	682	673	652	618	579	540	468	318	222	150
July	202	136	84	43	31	56	121	239	440	562	617	669	708	734	744	734	711	676	633	591	555	508	375	267
August	180	121	74	40	28	50	109	217	415	547	598	644	680	703	712	703	683	650	612	574	541	465	341	239
September	0	0	0	0	0	0	0	6	150	345	523	567	600	622	630	622	603	572	537	474	321	183	93	27
October	0	0	0	0	0	0	0	0	0	143	366	539	574	596	605	596	577	546	453	291	121	6	0	0
November	0	0	0	0	0	0	0	0	0	0	0	120	255	324	351	324	264	138	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	19	40	19	0	0	0	0	0	0	0	0

TOTAL COOLING DEGREE HOURS PER YEAR:

NO ECONOMIZER:

118,798

ECONOMIZER ON:

56,670

COMPRESSOR/CONDENSER ENERGY ****

52.3 %

ECO B11

Sheet 8 of 16.

ECO B11
Sheet 9 of 16

file B11-HAND.WQ1

USE RESULTS ONLY FOR HAND-CALC BLDGS

BUILDING NO.	COMPRESSO kWH/Yr	CONDENSE kWH/Yr	ECO B6/7 Savings	SAVINGS kWH/Yr	ENERGY COST SAVED/YEAR	
120	6,234	Included	0	3,260	$220	
121	11,475	1,511	186	6,694	$453	TRACE 600
161	4,470	Included	2,006	1,289	$87	
162 *	4,470	0	2,006	1,289	$87	
163 *	4,470	0	2,006	1,289	$87	
164 *	4,470	0	2,006	1,289	$87	
165 *	4,470	0	2,006	1,289	$87	
166 *	4,470	0	2,006	1,289	$87	
167 *	4,470	0	2,006	1,289	$87	
177	12,779	1,193	3,526	5,463	$369	TRACE 600
178	15,974	1,491	5,588	6,211	$420	
186	7,546	Included	3,197	2,274	$154	
190 *	34,548	Included	0	18,067	$1,221	
197	12,691	Included	0	6,637	$449	
209	43,780	2,090	11,449	18,001	$1,217	
240	8,936	728	0	5,054	$342	
241	16,565	2,186	0	9,806	$663	TRACE 60
290	12,581	1,554	9,292	2,533	$171	TRACE 60
291	7,727	738	5,142	1,738	$117	TRACE 60

* nic on following summary analysis, but are included in LCC analysis sheet.

Building No.	Cost Estimate Subtotal	Construction Total	Investment Total	O&M/YR Saved	O&M LCC $	Energy Svg/Yr	Energy LCC $	Savings Total $/Yr	Savings LCC $	Payback Years	SIR
120	$4,538	$7,079	$7,893	($177)	($1,968)	$220	$2,578	$43	$611	181.8	0.237
121	$2,830	$4,414	$4,922	($110)	($1,227)	$453	$5,294	$342	$4,067	14.4	0.768
161	$2,560	$3,993	$4,452	($100)	($1,110)	$87	$1,019	($13)	($91)	(350.0)	(0.089)
162	$2,560	$3,993	$4,452	($100)	($1,110)	$87	$1,019	($13)	($91)	(350.0)	(0.089)
177	$2,510	$3,915	$4,365	($98)	($1,088)	$369	$4,321	$271	$3,232	16.1	0.748
178	$4,612	$7,194	$8,021	($180)	($2,000)	$420	$4,913	$240	$2,913	33.4	0.593
186	$2,560	$3,993	$4,452	($100)	($1,110)	$154	$1,799	$54	$689	82.6	0.383
197	$2,830	$4,414	$4,922	($110)	($1,227)	$449	$5,249	$338	$4,022	14.5	0.766
209	$2,440	$3,806	$4,244	($95)	($1,058)	$1,217	$14,237	$1,122	$13,179	3.8	0.926
240	$4,435	$6,918	$7,713	($173)	($1,923)	$342	$3,997	$169	$2,074	45.7	0.519
241	$3,980	$6,208	$6,922	($155)	($1,726)	$663	$7,756	$508	$6,030	13.6	0.777
290	$5,219	$8,141	$9,077	($204)	($2,263)	$171	$2,003	($32)	($260)	(281.2)	(0.130)
291	$5,219	$8,141	$9,077	($204)	($2,263)	$117	$1,374	($86)	($889)	(105.5)	(0.647)
Totals	$46,293	$72,210	$80,514	($1,805)	($20,074)	$4,749	$55,561	$2,944	$35,486	27.4	0.639

Construction Cost....Installed Cost
O&M/YR....................Yearly maintenance scheduled as 2.5% of installed cost per year
Sales Tax...................8% of total
OH & P.......................Contractors overhead and profit 30%
Bond..........................1%
Contingency.............Estimators contingency 10%
SIOH & Design Costs.................. SIOH = 5.5 %; Design 6.0% of Construction Cost
Electric Energy Cost Savings...................Yearly savings multiplied by UPW factor for 15 years (11.70)
Added O&M Costs....................Yearly amount multiplied by UPW factor for 15 years (11.12)
Payback Period .... Total Investment divided by Total Annual Cost Savings
SIR.............................Savings/(Cost+Maint*UPW)

Note: Minor differences between this summary and other tabular calculations are due to rounding errors.

note, some bldgs not included in this list, see sheet 9 of 16

ECO B11
Sheet 10 of 16

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993
Sheet 11 OF 16

Project: EEAP Limited Energy Study
Project No.: 16-403-10
Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California
Engineer-Architect: Keller & Gannon
Drawing No.: ECO-B11 (Economizer)
Estimator: RJB
Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg 120							
Barrometric Relief Damper	2	ea	$34	$67	$96	$192	$259
Opposed Blade Dampers	4	ea	$61	$242	$205	$820	$1,062
Damper Actuator	4	ea	$30	$121	$197	$788	$909
Controls	2	ea	$90	$180	$316	$632	$812
Ductwork (Insulated 1")	100	lbs	$6	$579	$4	$436	$1,015
Retrofit Existing Components	12	MH	40.1	$481			$481
Subtotal (Bldg 120)							$4,538
Bldg 121							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$61	$121	$205	$410	$531
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	20	MH	40.1	$802			$802
Subtotal (Bldg 121)							$2,830
Bldg 161							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$61	$121	$205	$410	$531
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	12	MH	40.1	$481			$481
Penetrate Building	1	ea	$50	$50			$50
Subtotal (Bldg 161)							$2,560
Sub Total (Sheet)							$9,928

CONSTRUCTION COST ESTIMATE		Date Prepared February 1993	Sheet 12 OF 16
Project EEAP Limited Energy Study		Project No. 16-403-10	Basis for Estimate Code A (no design competed)
Location Fort Hunter-Liggett, California			
Engineer-Architect Keller & Gannon			
Drawing No. ECO-B11 (Economizer)	Estimator RJB		Checked By BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg 162							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$61	$121	$205	$410	$531
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	12	MH	40.1	$481			$481
Penetrate Building	1	ea	$50	$50			$50
Subtotal (Bldg 162)							$2,560
BLDG 163, 164, 165, 166, 167 added to LCCA sheet.							
Bldg 178							
Barrometric Relief Damper	2	ea	$34	$67	$96	$192	$259
Opposed Blade Dampers	4	ea	$61	$242	$205	$820	$1,062
Damper Actuator	4	ea	$30	$121	$197	$788	$909
Controls	2	ea	$90	$180	$316	$632	$812
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	24	MH	40.1	$962			$962
Penetrate Building	2	ea	$50	$100			$100
Subtotal (Bldg 178)							$4,612
Bldg 241							
Opposed Blade Dampers	6	ea	$61	$363	$205	$1,230	$1,593
Damper Actuator	3	ea	$30	$91	$197	$591	$682
Louvers	2	ea	$34	$68	$58	$116	$184
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	100	lbs	$6	$579	$4	$436	$1,015
Penetrate Bldg	2	ea	$50	$100		$0	$100
Retrofit Existing Components	24	MH	40.1	$962			$962
Subtotal (Bldg 241)							$3,980
Sub Total (Sheet)							$11,151

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993	Sheet 13 OF 16		
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: . Keller & Gannon			
Drawing No.: ECO-B11 (Economizer)	Estimator: RJB	Checked By: BIH	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg 177							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$61	$121	$205	$410	$531
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	12	MH	40.1	$481			$481
Subtotal (Bldg 177)							$2,510
Bldg 186							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$61	$121	$205	$410	$531
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	12	MH	40.1	$481			$481
Penetrate Building	1	ea	$50	$50			$50
Subtotal (Bldg 186)							$2,560
				Same	cost	as 190	
Sub Total (Sheet)							$5,069

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 14	OF 16
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO-B11 (Economizer)	Estimator: RJB	Checked By: BIH	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg 197							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$61	$121	$205	$410	$531
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	20	MH	40.1	$802			$802
Subtotal (Bldg 197)							$2,830
Bldg 209							
Barrometric Relief Damper	1	ea	$34	$34	$96	$96	$130
Opposed Blade Dampers	2	ea	$56	$111	$175	$350	$461
Damper Actuator	2	ea	$30	$61	$197	$394	$455
Controls	1	ea	$90	$90	$316	$316	$406
Ductwork (Insulated 1")	50	lbs	$6	$290	$4	$218	$508
Retrofit Existing Components	12	MH	40.1	$481			$481
Subtotal (Bldg 209)							$2,440
Bldg 240							
Opposed Blade Dampers	4	ea	$56	$222	$175	$700	$922
Damper Actuator	4	ea	$30	$121	$197	$788	$909
Controls	1	ea	$145	$145	$482	$482	$627
Ductwork (Insulated 1")	100	lbs	$6	$579	$4	$436	$1,015
Retrofit Existing Components	24	MH	40.1	$962			$962
Subtotal (Bldg 240)							$4,435
Sub Total (Sheet)							$9,705

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet: 15	OF: 16
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO-B11 (Economizer)	Estimator: RJB	Checked By: BIH	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg 290							
Opposed Blade Dampers	6	ea	$61	$363	$205	$1,230	$1,593
Damper Actuator	3	ea	$30	$91	$197	$591	$682
Louvers	2	ea	$45	$90	$75	$150	$240
Controls	1	ea	$145	$145	$482	$482	$627
Ductwork (Insulated 1")	100	lbs	$6	$579	$4	$436	$1,015
Retrofit Existing Components	24	MH	40.1	$962			$962
Penetrate Building	2	ea	$50	$100			$100
Subtotal (Bldg 290)							$5,219
Bldg 291							
Opposed Blade Dampers	6	ea	$61	$363	$205	$1,230	$1,593
Damper Actuator	3	ea	$30	$91	$197	$591	$682
Louvers	2	ea	$45	$90	$75	$150	$240
Controls	1	ea	$145	$145	$482	$482	$627
Ductwork (Insulated 1")	100	lbs	$6	$579	$4	$436	$1,015
Retrofit Existing Components	24	MH	40.1	$962			$962
Penetrate Building	2	ea	$50	$100			$100
Subtotal (Bldg 191)							$5,219
Sub Total (Sheet)							$10,438
Sub Total (ECO B-11)							$46,292
Sales Tax 8%							$3,703
Sub Total							$49,995
Contractor O.H. & P 30%							$14,999
Sub Total							$64,994
Bond 1%							$650
Sub Total							$65,643
Estimating Contingency 10%							$6,564
Sub Total							$72,208
Total Probable Construction Cost							~~[illegible]~~

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B11
Sheet 16 fo 16

Location: Fort Hunter Liggett, California Region No. 4 Project No. 16-403-10
Project Title: Retrofit Economizers Fiscal Year FY96
Discrete Portion Name: ECO# B-11
Analysis Date: March 1993 Economic Life: 15 YEARS Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$96,168		
B. SIOH	$5,289		
C. Design Cost	$5,770		
D. Total Cost (1A+1B+1C)	$107,227		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$107,227

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$19.81	323.4	$6,407	11.70	$74,959
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	0.0 k	$0	11.70	$0
E. Other					
F. Total			$6,407		$74,959

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	16.7	Years
5. Total Net Discounted Savings (2F5+3C):	$74,959	
6. Savings to Investment Ratio (SIR) 5/1G:	0.70	
7. Adjusted Internal Rate of Return (AIRR):	Negative	

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H
CHECKED BY
DATE MARCH 1993
REV. 19

ECO B12
INSTALL BOILER OXYGEN TRIM CONTROLS

PROJECT 16-403-10 FHL EEAP
SHEET NO. 1 OF 2 SHEETS

DESCRIPTION OF ACTION

Install oxygen trim controls on HW and Steam boilers. Energy is saved by improved combustion control; higher system efficiencies are achieved. Depending on load conditions, savings of 1.5% to 3.0% of fuel use can be achieved.

FACILITIES INCLUDED

Only larger boilers can cost effectively be retrofit with such controls, buildings identified to evaluate include: BARRACKS COMPLEX BUILDINGS (205, 206, 207, 208, 229 & 230), each with 1,875,000 BTUH firing rate boilers.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H
CHECKED BY
DATE MARCH 1993
REV. 19

ECO B12

PROJECT

SCREENING ANALYSIS

FUEL OIL USE IN BARRACKS BOILER SYSTEMS

205, 206, 207, 208, 229, 230 HAVE 7 IDENTICAL BLRS

TOTAL EXISTING FUEL OIL USE

HVAC	10,820	$\times 10^6$ BTU/YR
DHW	2,789	$\times 10^6$ BTU/YR
TOTAL	13,609	$\times 10^6$ BTU/YR

FUEL OIL COST \$4.98 / 10^6 BTU

ANNUAL COST SAVINGS:

ASSUME 1 1/2 % SAVINGS (LESS SAVINGS ON THESE SMALL BOILERS)

13,609 × 0.015 = 204 × 10^6 BTU/YR POTENTIAL SAVINGS

\$4.98 × 204 = \$1016 /YR —— " ——

LIFE CYCLE SAVINGS, ASSUME 15 YR LIFE

UPW = 13.78 LIFE CYCLE ENERGY COST SAVINGS

\$1016 × 13.78 = \$14,009 LIFE CYCLE COST SAVINGS.

IN 1982 A RETROFIT O_2 TRIM CONTROL SYSTEM COST ABOUT \$6600 EACH. TO ACHIEVE \$14,009 SAVINGS, 7 OF THESE CONTROLS MUST BE INSTALLED FOR A MINIMUM OF 7 × \$6600 = \$46000 IN 1982 DOLLARS.

THE CONCEPT IS NOT ECONOMIC AT FORT HUNTER-LIGGETT BOILER SIZES

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BHT
DATE FEB 1993
REV. 19__

ECO# B-13
INDIRECT EVAPORATIVE PRECOOLERS

PROJECT 16-403-01
TIR FEAP

SHEET NO. 1 OF 11 SHEETS

DESCRIPTION OF ACTION

THE CONFIGURATION SELECTED FOR ANALYSIS IS INDIRECT PRECOOLING OF AIR SUPPLIED TO EXISTING AIR CONDITIONING SYSTEMS. ENERGY SAVINGS WILL BE ACHIEVED BY EVAPORATIVE COOLING. THE USE OF DIRECT TYPE EVAPORATIVE COOLING IS NOT INDICATED IN ORDER TO MINIMIZE PROBLEMS THAT WOULD ARISE DUE TO INCREASED MOISTURE IN AIR STREAMS.

FACILITIES INCLUDED

1203
205
207
208
229
230
295

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY ______
CHECKED BY ______
DATE ______ 19__
REV. ______ 19__

ECO B-13

PROJECT ______

SHEET NO. 2 OF 11 SHEETS

BLDG 128

ENERGY USE WITH ECO # 6,7 (COMPRESSOR)
45,379.9 KWH/YR

BLOCK LOAD @ 95°FDB 70°FWB = 727,663 BTUH

INDIRECT EVAP COOLER EFFICIENCY = 75%

∴ NEW ENTERING AIR CONDITIONS = 95 - .75 (95-70) = 76

ASSUME CONSTANT MOISTURE CONTENT SO FROM PSYCHROMETRICS EAT = 76/64

USE $CFM \times 4.45 (H_E - H_L) = BTUH$

E = ENTERING COIL
L = LEAVING COIL
1 = WITHOUT INDIRECT EVAP PRE-COOL
2 = WITH INDIRECT EVAP PRECOOL

$CFM_1 \times 4.45 (H_{E_1} - H_{L_1}) = BTUH_1$

$\therefore CFM_1 = BTUH_1 / 4.45 (H_{E_1} - H_{L_1})$

$CFM_1 = CFM_2 \; ; \; H_{L_1} = H_{L_2} = H_*$

$\therefore BTUH_1 / 4.45 (H_{E_1} - H_*) = BTUH_2 / 4.45 (H_{E_2} - H_*)$

H_* @ 55°DB/54°WB = 22.5 BTU/lb
H_{E_1} @ 95°DB/70°WB = 34 BTU/lb
H_{E_2} @ 76°DB/64°WB = 29 BTU/lb

$\therefore BTUH_2 = BTUH_1 \left(\frac{H_{E_2} - H_*}{H_{E_1} - H_*} \right) = BTUH_1 (0.565)$

$= 411,288$ BTUH

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RJB
CHECKED BY BJH
DATE FEB 1993
REV. 19

ECO# B13
EVAPORATIVE PRECOOLERS
ENERGY SAVINGS CALCULATIONS

PROJECT 16-403-10
FITZ FEAP

SHEET NO. 3 OF 11 SHEETS

ENERGY SAVINGS = 45,379.9 KW/YR × $\left(\frac{727,663 - 411,288}{727,663}\right)$

= 19,730.4 KW/YR × .07454 $/KWH

= $1,470/YR

SIMILARLY FOR BLDGS:

205 & 207

BTUH = 618,719 (FROM BLDG 207 TRANE 600 RUN)

$BTUH_2$ = 618,719 (0.565) = 349,576

ENERGY USE W/ ECO# 6,7 = 75,112 KWH/YR

SAVINGS = 75,112 $\left(\frac{618,719 - 349,576}{618,719}\right)$

= 32,673 KWH/YR × .07454 $/KWH

= $2,436 / YR

208, 229, 230: $\frac{79,250}{75,112}$ × 32,673 = 34,473 KWH/Yr. Saved

34,473 × 0.07454 $/KWH = $2,570 /YR SAVED

295 BTUH = 1,127,723

$BTUH_2$ = 1,127,723 × (0.565) = 637,163

KWH = 93,825

SAVINGS = 93,825 $\left(\frac{1,127,723 - 637,163}{1,127,723}\right)$

= 40,814 KWH/YR × .07454 $/KWH

= $3,042 /YR

FORM 101-1/8

CONSTRUCTION COST ESTIMATE			Date Prepared February 1993		SHEET 4 OF 11		
Project EEAP Limited Energy Study			Project No. 16-403-10		Basis for Estimate Code A (no design competed)		
Location Fort Hunter-Liggett, California							
Engineer-Architect Keller & Gannon							
Drawing No. ECO-B13 (Indirect Evap. Pre-cooler)		Estimator RJB			Checked By BIH		

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Indirect Evap. Pre-cooler	1	EA	$2,550	$2,550	$850	$850	$3,400
Ductwork	25	lbs	$3	$70	$2	$59	$129
Concrete Pad	4	CY	$19	$76	$47	$188	$264
1/2" Cu Piping (Water & Drain)	100	Ft	$3	$310	$1	$128	$438
Power & Control Wiring	1	Job	$75	$75	$100	$100	$175
Subtotal							$4,406

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY
CHECKED BY
DATE 19
REV. 19

ECO B-13

PROJECT

SHEET NO. 5 OF 11 SHEETS

ANALYSES

BLDG 128 50MN BARRACKS / BOQ

Individual thru-wall FCU's on CHW & HW distribution, total = ~60 FCU's.

one precooler can serve 2 units, total constr. Cost: $4406 × 60 = $264,360

Energy Cost Savings, neglecting evap cooler fan power use: $1407/year

15-year UPW = 11.7 for electricity:

11.7 × 1407 = $16,462

DOES NOT PAY BACK.

BLDGS 205, 207, 208, 229, 230

Potential energy & cost savings estimated on previous sheet ~ $3,042/year

Life Cycle Savings: 11.7 × 3042 = $35,590 (neglecting added evap cooler fan)

Seems like a retrofit is possible. Refer to attached faxes with equip. supplier.

⇒ Although potential for indirect evap cooling, heat pipes, etc. is very good in barracks bldgs, configuration of mech. rooms, locations of OSA & relief assemblies and layout of ductwork preclude installation of such systems.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY ____ CHECKED BY ____ DATE ____ 19__ REV. ____ 19__

ECO B-13

PROJECT ____

SHEET NO. 6 OF 11 SHEETS

Air flows into mechanical room must also be increased by ~150%. There is not enough open area to accomodate this without a major structural change which would cost more than LCC energy cost savings.

Bldg 295. There are over 120 individual FCUs in this bldg. retrofit costs would be prohibitive compared to the estimated $3042/yr electricity cost savings.

NO FURTHER ACTION CONDUCTED ON THIS ECO.

FORM 101-1/8

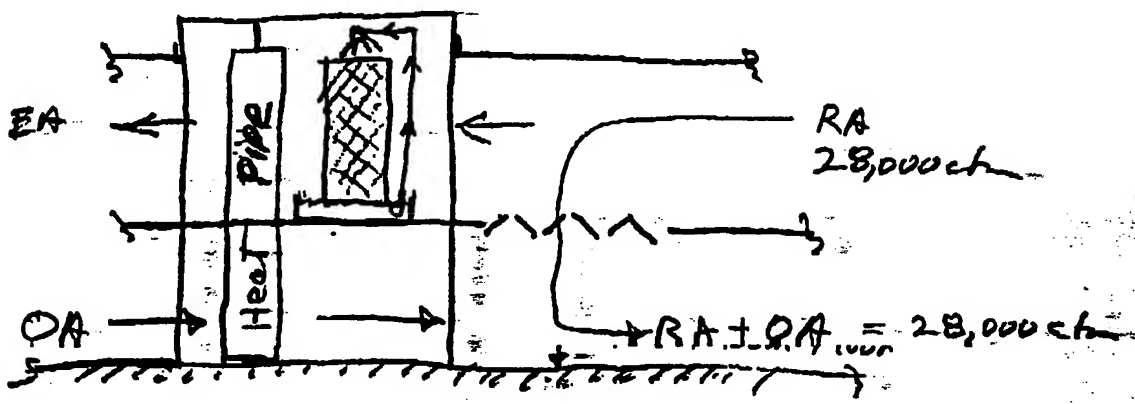
ECO B13 Sheet 7 of 11

FAX TO Blair Horst
Keller & Gannon

Re Fort Hunter Liggett
Project

Conservation Mechanical Systems Inc.
2561 Westberry Drive
Santa Rosa, CA 95403
Phone and FAX 707-528-4016

Heat Pipe Dry evap. cooler Assembly



Blair — this is the idea I have in mind. This unit would cool 102°F/71°F Outdoor Air down to 78 °F DB 63.3°F WB entering your refrigeration DX coils. This is based on a 63% overall indirect evap. cooling efficiency (90% Saturation Efficiency + 70% heat pipe efficiency). No heat pipe maintenance since we are using a wetted media evap. cooler and not spraying the heat exchanger.

Best
Mike Scofield

ECO B-13 Sheet 8 of 11

Post-It™ brand fax transmittal memo 7671	# of pages ▸ 4
To Mike Scofield	From Blair Horst
Co. CMS	Co. Keller & Gannon
Dept.	Phone # 415/621-1199
Fax # (707) 528-4016	Fax # 415/864-3681

Mike,

As discussed, design:

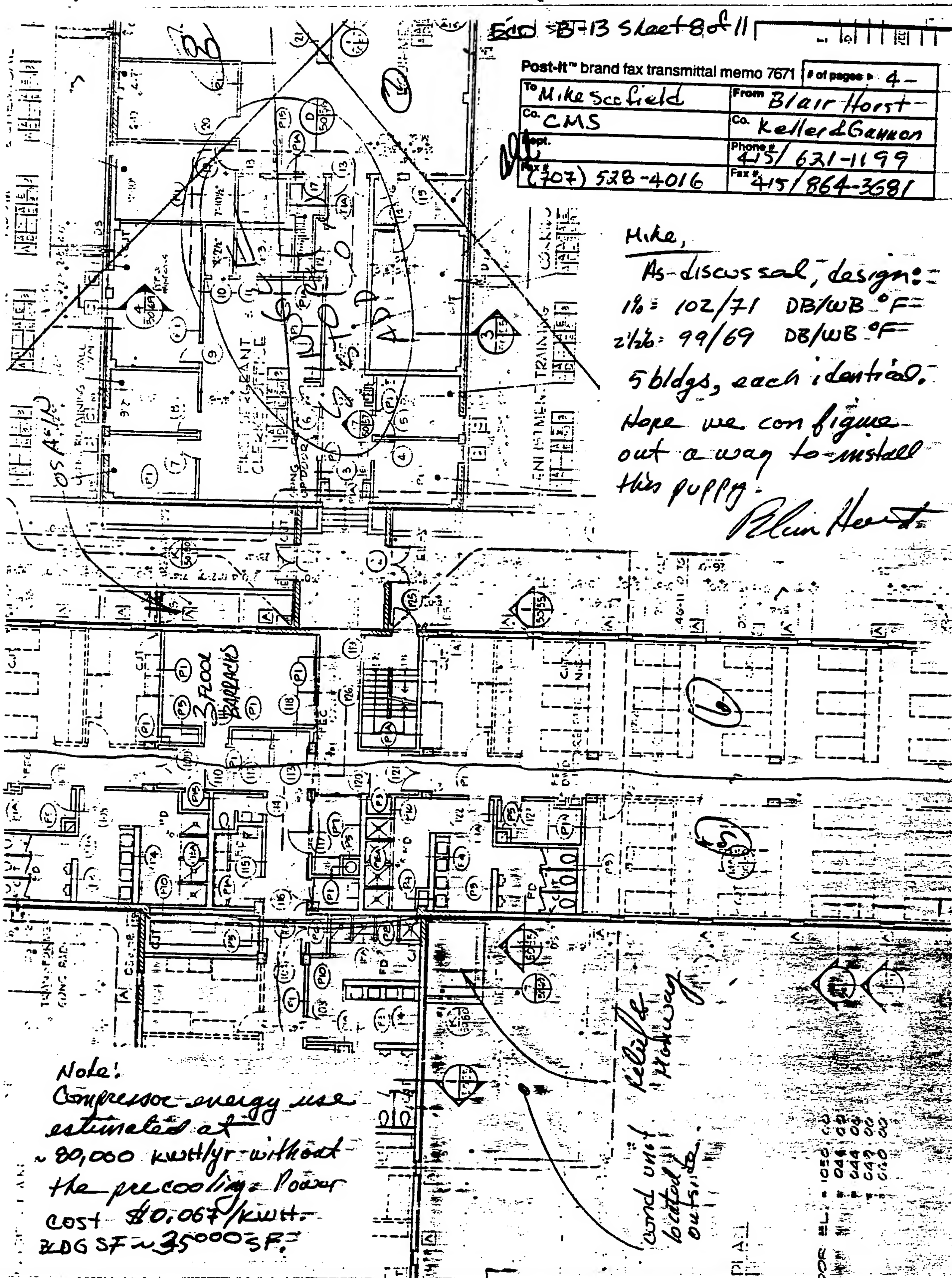
1% = 102/71 DB/WB °F

2½%: 99/69 DB/WB °F

5 bldgs, each identical.

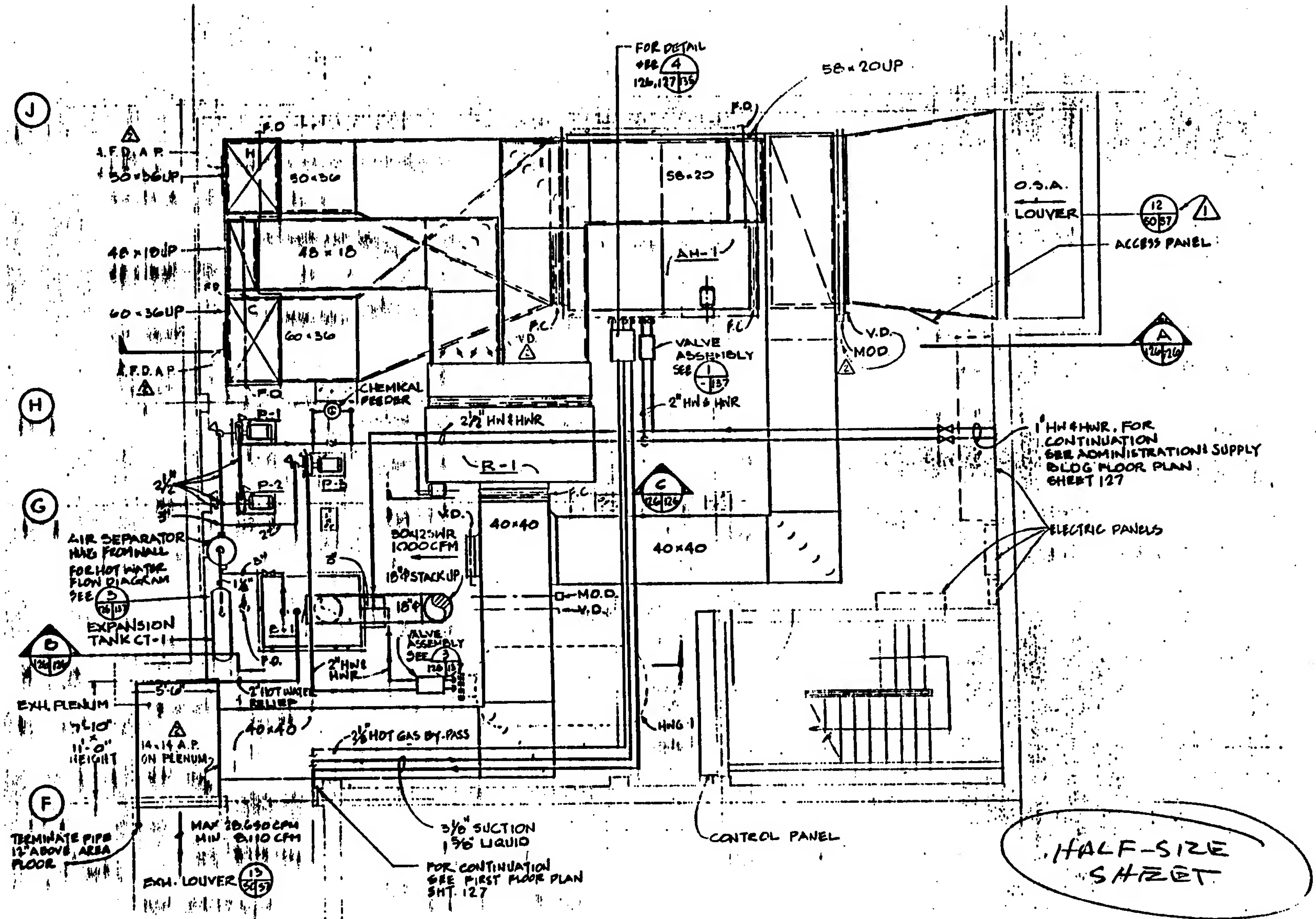
Hope we can figure out a way to install this puppy.

Blair Horst



Note:
Compressor energy use estimated at ~80,000 kWH/yr without the precooling. Power cost $0.067/kWH.
BLDG SF ~35000 SF.

ECO B13 Sheet 9 of 11



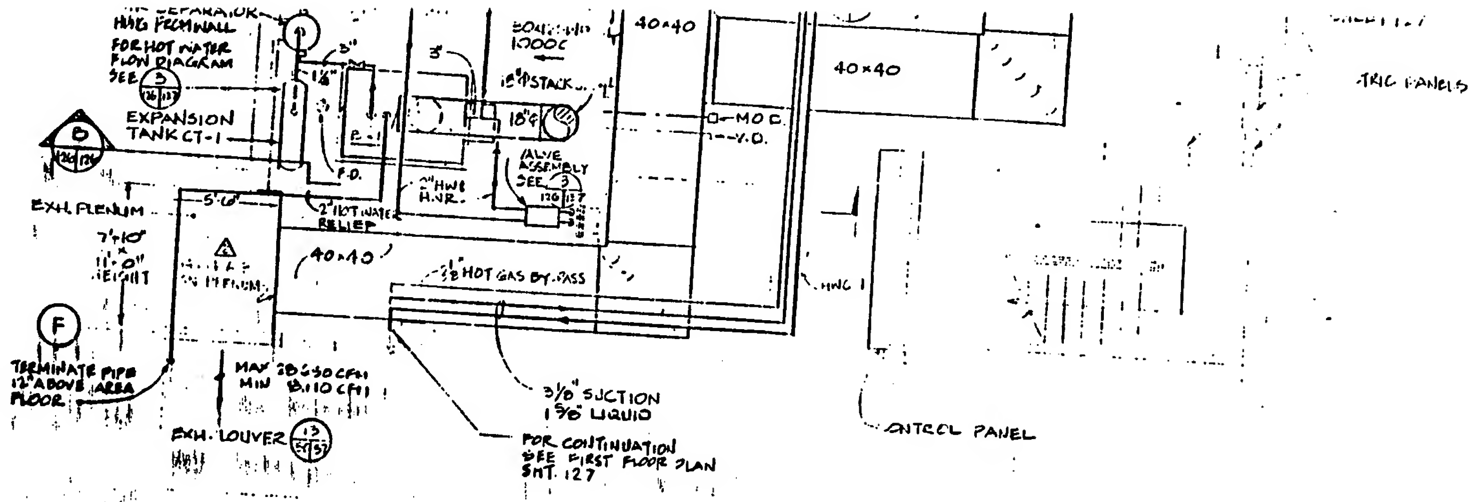
BARRACKS BASEMENT MECHANICAL ROOM FLOOR PLAN

SCALE: ¼" = 1'-0"

BASIC BID (EMB NOS. 1,2,4 & 5)
+ ADDITIVE NO. 1 (EMB NO. 3)

8

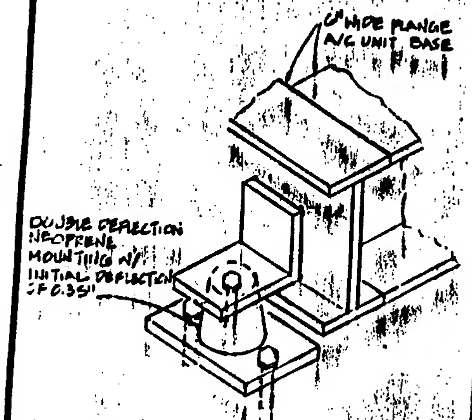
5



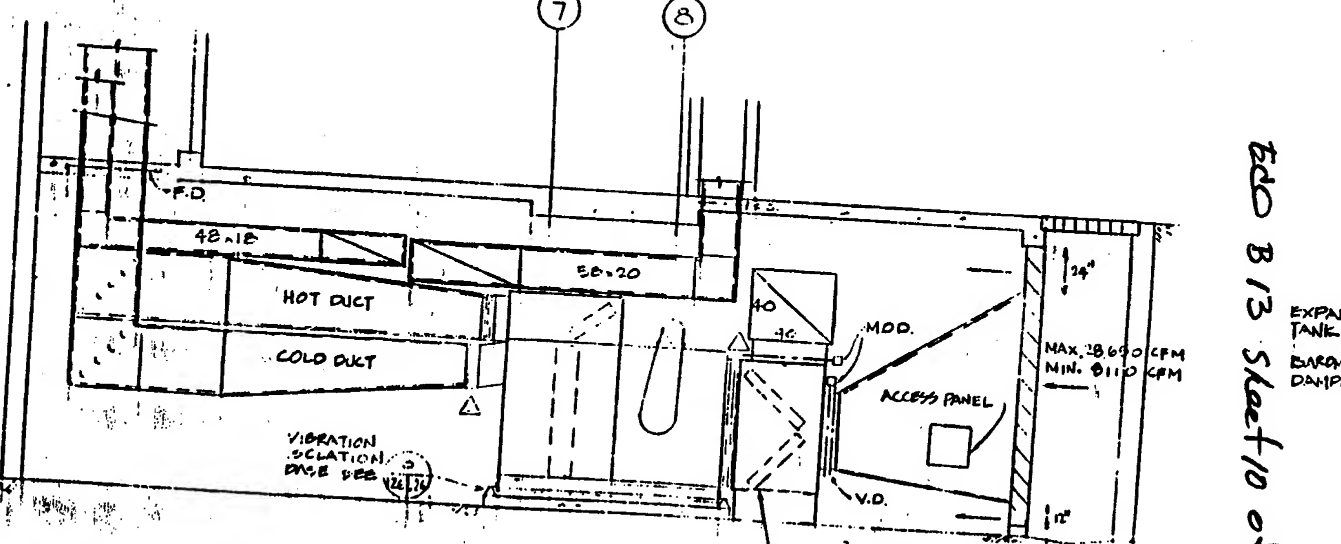
HALF SIZE SHEET

1 126 126 BARRACKS BASEMENT MECHANICAL ROOM FLOOR PLAN
SCALE: 1/4" = 1'-0"

BASIC BID (EMB NOS. 1, 2, 4 & 5)
+ ADDITIVE NO. 1 (EMB NO. 3)



DETAIL 3 126 126
NO SCALE

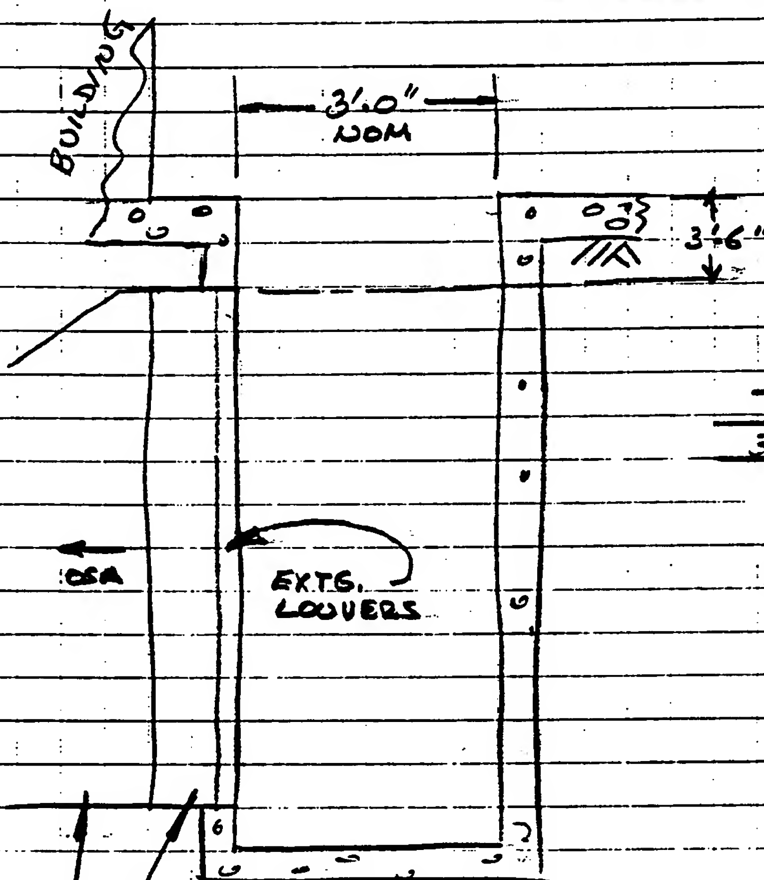


A 126 126 SECTION
SCALE: 1/4" = 1'-0"

ECO B13 Sheet 10 of 11

ECO B-13
sheet 11 of 11

INDIRECT EVAPORATIVE PRE COOLER RETROFIT



TYPICAL OF 5
3-FLOOR BARRACKS
BUILDINGS

FORT HUNTER LIGGETT

BLDGS 205, 207
208
229 & 230

REMOVE LOUVERS, INSTALL PRECOOLER CELLS.
11' HIGH x 12' (NOMINAL WIDTH)
4" DEEP LOUVERS 1/2" SETBACK FROM CONC.
BEAM FACE.

MAX OSA @ DESIGN 28,650 CFM

APPROX 8 LF TO MOTORIZED DAMPER & RA-DUCT
JUNCTION

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY
DATE MARCH 1993
REV. 19

ECO # B14
RESET DUAL-DUCT SA TEMPERATURES

PROJECT FHL EEAP 16-403-10
SHEET NO. ___ OF ___ SHEETS

DESCRIPTION OF WORK

ON BUILDINGS WITH DUAL-DUCT SYSTEMS RESET COOLING SUPPLY AIR TEMPERATURE LOWER AND RESET HEATING SUPPLY AIR TEMPERATURE HIGHER AT PARTIAL LOAD TIMES

EVALUATION SUMMARY / APPROACH

DUAL-DUCT SYSTEMS ARE ENERGY WASTEFUL AT ANY CONDITION OTHER THAN FULL LOAD. AT PART LOAD CONDITIONS THE MIXING BOXES MIX HOT & COLD SUPPLY AIR TO VARY THE SUPPLY AIR TEMPERATURE TO MEET THE LOAD. SINCE ONLY THE MIXED AIR TEMPERATURE CHANGES THE SYSTEM MUST HEAT THE SAME QUANTITY OF AIR AND COOL THE SAME AIR QUANTITY EVEN AT PART LOAD CONDITIONS, ONLY THE PROPORTION OF HOT TO COLD AIR SUPPLIED TO THE ROOM CHANGES THE TOTAL AIR QUANTITY STAYS THE SAME.

RESETTING THE HOT AND COLD DECK TEMPERATURE WILL REDUCE THE ENERGY REQUIRED TO CONDITION THE BUILDINGS BUT CONTROLS HAVE TO BE INSTALLED THAT TELL THE AIR HANDLING UNIT TO LEAVE THE TEMPERATURES ALONE IF AT LEAST ONE ZONE CALLS FOR FULL HEATING OR COOLING.

THUS IN SYSTEMS LIKE BUILDING 381 WHERE SOME INTERNAL ZONES DOMINATED BY COMPUTER EQUIPMENT LOAD THE COLD DECK TEMPERATURE CANNOT BE RESET

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet Of

Project: EEAP Limited Energy Study

Project No.

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO-B14 Reset Dual-Duct Temperatures

Estimator

Checked By

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Install Discriminator Controls to Query							$0
Each Zone to Look for Peak Htg/Clg							
Multi-Channel DDC Controller	1	EA	-	$2,700	-	$3,000	$5,700
includes soft/programming							
Temperature Contols for Coils	2	EA	-	$1,000	$500	$1,000	$2,000
Room Temp. Sensor/Transmitters	6	EA	-	-	$610	$3,660	$3,660
Conduit/Wiring	150	LF	$10	$1,500	$5	$750	$2,250
Testing and Balancing	1	LS	-	$2,000	-	-	$2,000
Subtotal							$15,610
Sales Tax @ 8%							$1,249
Subtotal							$16,859
Contractor OH & Profit @ 30%							$5,058
Subtotal							$21,916
Bond @ 1%							$219
Subtotal							$22,136
Estimating Contingency @ 10%							$2,214
Total Probable Construction Cost							$24,349

ECO - B14 Reset Dual-Duct Hot and Cold Deck Temperatures

				ECO- B14 Energy Savings							
Fac.	Supply Fan CFM	Hot Deck Mil Btu / Yr	Cold Deck Mil Btu / Yr	Fuel Oil Mil Btu / Yr	Propane Mil Btu / Yr	Electricity Mil Btu / Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann $ Savings	LCC $ Savings	Investment
80	6,300	118.9	73.5	-	-	192.3	-	-	$3,507	$41,026	$24,300
206	16,600	77.3	51.6	88	-	51.6	$440	-	$940	$17,063	$24,300
241	8,190	38.2	45.8	-	-	84.0	-	-	$1,531	$17,915	$24,300
287	5,600	26.1	25.7	-	32.6	25.7	-	$257	$468	$9,112	$24,300
301	6,280	42.2	-	-	-	42.2	-	-	$769	$9,001	$24,300
		303	197	88	32.6	25.7	$440	$257	$7,215	$94,117	$121,500

The Assumption was made that the Hot Deck Temperature would not be reset during Full Load Heating Hours and the Cold Deck Temperature would not be reset during Full Load Cooling hours.

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JGS
CHECKED BY
DATE MARCH 1993
REV. 19

ECO # B 14
RESET DUAL-DUCT
SA TEMPERATURES

PROJECT FHL EEAP
16-403-10

SHEET NO. ___ OF ___ SHEETS

ORDER OF IMPLEMENTATION

THIS ECO WAS ASSUMED NOT TO BE IMPLEMENTED

FORM 101-1/8

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: ECO-B14 Reset Dual-Duct Temperatures   Fiscal Year - FY96
Discrete Portion Name: Bldgs. 80, 206, 241, 287, & 301
Analysis Date: March 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$121,500		
B. SIOH	$6,683		
C. Design Cost	$0		
D. Total Cost (1A+1B+1C)	$128,183		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$128,183

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	396	$7,217	11.70	$84,442
B. Dist	$4.98	88	$438	13.78	$6,039
C. Propane	$7.87	32	$252	14.16	$3,566
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		516	$7,907		$94,047

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):   16.2 Years
5. Total Net Discounted Savings (2F5+3C): $94,047
6. Savings to Investment Ratio (SIR) 5/1G: 0.73
7. Adjusted Internal Rate of Return (AIRR):   -1%

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY
DATE MARCH 1993
REV. JUNE 1993

ECO #B15
CONVERT MULTIZONE UNITS TO VARIABLE AIR VOLUME

PROJECT FHL EEAP
16-403-10

SHEET NO. 1 OF 5 SHEETS

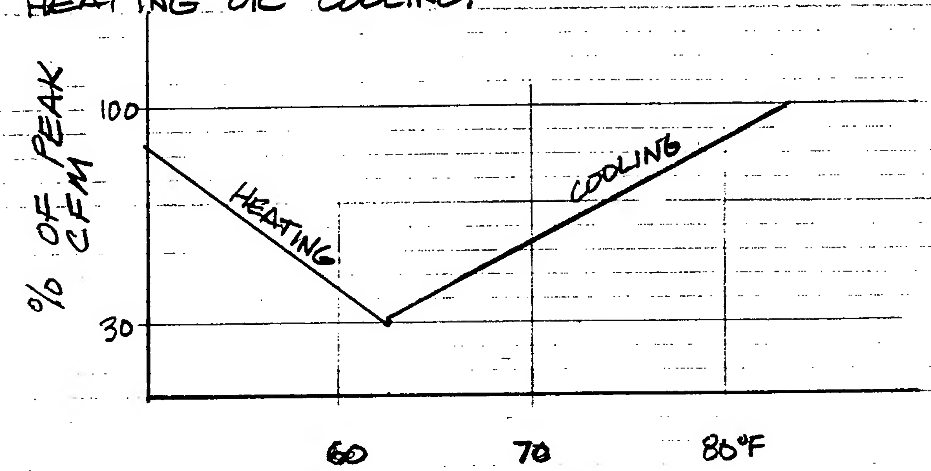
DESCRIPTION OF WORK

REDUCE FAN ENERGY CONSUMED IN BUILDINGS 205, 207, 208, 229 AND 230 BY CONVERTING CONSTANT AIR VOLUME DUAL-DUCT AIR CONDITIONING SYSTEMS TO VARIABLE AIR VOLUME SYSTEMS.

EVALUATION SUMMARY / APPROACH

THIS ECO FEATURES THE REMOVAL OF THE DUAL DUCT MIXING BOXES AND CONTROLS AND THEIR REPLACEMENT WITH DUAL-DUCT VAV BOXES.

AS SHOWN BELOW THE VARIABLE AIR VOLUME SYSTEM SAVES FAN ENERGY DURING ALL TIMES DURING THE YEAR EXCEPT THOSE HOURS SPENT AT FULL LOAD HEATING OR COOLING.



THE BARRACKS BUILDINGS WERE ASSUMED TO BE DOMINATED BY EXTERNAL LOADS. THEREFORE THE REQUIRED AIR FLOW WITH TRACK OUTSIDE TEMPERATURE

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY
DATE MARCH 1993
REV. JUNE 1993

ECO #B 15
CONVERT DUAL-DUCT UNITS TO VARIABLE AIR VOLUME

PROJECT FHL EEAP 16-403-10
SHEET NO. 2 OF 5 SHEETS

THE FOLLOWING SCHEDULE WAS DERIVED FROM THE LOCAL WEATHER DATA TO APPROXIMATE THE AIR QUANTITY SUPPLIED BY THE VARIABLE AIR VOLUME SYSTEM.

TEMPERATURE RANGE	PERCENT TOTAL CFM	PERCENT OF YEAR AT THIS LOAD
OVER 80°F	100%	7%
50°F TO 80°F	80%	52%
30°F TO 50°F	40%	40%
BELOW 30°F	100%	1%

ORDER OF IMPLEMENTATION

THIS ECO WAS ASSUMED TO BE IMPLEMENTED.

FORM 101-1/8

ECO - B15 Convert Multizone HVAC System to Variable Air Volume

Fac.	Fan Amps		Full Load	VAV System	Savings	Energy Cost Saved		O&M Cost Saved		Constr.	Investment	Pay-	SIR
No.	SA Fan	RA Fan	kW hr / Yr	kW hr / Yr.	kW hr / Yr	$/Yr	LCC$	$/Yr	LCC$	Cost $	$	Back	
205	55	23	153,424	101,260	52,164	$3,246	$37,973	($200)	($2,224)	$24,458	$27,271	8.95	1.31
207	54	21	147,523	97,365	50,158	$3,121	$36,513	($200)	($2,224)	$24,458	$27,271	9.34	1.26
208	54	21	147,523	97,365	50,158	$3,121	$36,513	($200)	($2,224)	$24,458	$27,271	9.34	1.26
229	59	23	161,292	106,453	54,839	$3,412	$39,921	($200)	($2,224)	$24,458	$27,271	8.49	1.38
230	46	22	134,410	88,710	45,699	$2,843	$33,267	($200)	($2,224)	$24,458	$27,271	10.32	1.14
		Totals	744,171	491,153	253,018	$15,743	$184,188	($1,000)	($11,120)	$122,292	$136,355	9.25	1.27

Annual Full Load Energy Consumption was calculated from measured phase voltage readings and operating hours of the building.

Full load kWHr / Year consumption of supply and return fans are reduced to 66% of existing usage due to the proposed VAV retrofit.

Energy cost savings are based on the year-round, continuous usage rate for power.

Annual O&M efforts for VAV system components are expeced to require an additional 5 MH per year of effort. At $40 per hour, annual cost per building VAV sytem is $200.

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 4 Of 5
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-B9 VAV Retrofit	Estimator: JCS	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 207							
Double-Duct VAV Box with T-stat	8	EA	$300	$2,400	$650	$5,200	$7,600
and duct static pressure sensor							
20 HP Variable Frequency Drive	1	LS	-	$1,200	-	$3,000	$4,200
installed w/ actuator							
Remove Constant Volume Mixing Boxe	8	LF	$250	$2,000	-	$0	$2,000
Testing and Balancing	1	LS	-	-	-	-	$1,880
Subtotal							$15,680
Sales Tax @ 8%							$1,254
Subtotal							$16,934
Contractor OH & Profit @ 30%							$5,080
Subtotal							$22,015
Bond @ 1%							$220
Subtotal							$22,235
Estimating Contingency @ 10%							$2,223
Total Probable Construction Cost							$24,458

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B15

SHT 5 OF 5

Location: Fort Hunter Liggett, California   Region No. 4   Project No.
Project Title: ECIP Facility Energy Improvements   Fiscal Year FY95
Discrete Portion Name: ECO B15 Convert Multizone HVAC Systems to Variable Air Volume
Analysis Date: June 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$122,292		
B. SIOH	$6,726		
C. Design Cost	$7,338		
D. Total Cost (1A+1B+1C)	$136,355		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$136,355

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors: October 1992

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	863.6	$15,743	11.70	$184,188
B. Dist	$4.98	0	$0	13.78	$0
C. Propane	$7.87	0	$0	14.16	$0
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		864	$15,743		$184,188

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($1,000)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($11,120)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4)   ($11,120)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 9.25 Years
5. Total Net Discounted Savings (2F5+3C): $173,068
6. Savings to Investment Ratio (SIR) 5/1G: 1.27
7. Adjusted Internal Rate of Return (AIRR): 5.67%

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY TLH
DATE FEB 1992
REV. 19__

ECO B-17
RELOCATE TRANSFORMER
PROJECT DESCRIPTION

PROJECT 16-403-10
THL EEAP

SHEET NO. 1 OF 5 SHEETS

DESCRIPTION OF ACTION

THE EXISTING 150 KVA TRANSFORMER LOCATED IN BLDG 301 WOULD BE REMOVED FROM THE COMPUTER ROOM AND PLACED IN A NON-AIR CONDITIONED SPACE. THIS WOULD SIGNIFICANTLY REDUCE THE AIR CONDITIONING LOAD FOR THE COMPUTER ROOM AND THUS SAVE ON ELECTRICAL COSTS.

A TRACE 600 RUN WAS MADE FIRST WITH THE TRANSFORMER LOAD AND HEAT WITHOUT. ECO'S ~~#~~ AND B-7 WERE CONSIDERED IMPLEMENTED IN BOTH CASES.

FORM 101-1/8

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

WITH XFMR

ECO B-17
SHEET 2 OF 5

..LIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 3
CRAC

---------- CALIFORNIA TITLE 24 COMPLIANCE REPORT ----------

Weather Name .... PASOROBL
Gross Conditioned Floor Area (sqft)...... 9,800
ACM Multiplier 1.025

---------- ENERGY USE SUMMARY ----------

	ELEC (kWh/yr)	GAS (kBtu/yr)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	0.0	25,995.8	5.6	27,364.0	2.9
Primary Cooling					
Compressor	13,891.0	0.0	10.2	142,244.0	14.9
Tower/Cond Fans	2,528.0	0.0	1.9	25,886.5	2.7
Condenser Pump	0.0	0.0	0.0	0.0	0.0
Other Accessories	3,331.2	0.0	2.5	34,111.6	3.6
Auxiliary					
Supply Fans	60,840.6	0.0	44.8	623,008.9	65.2
Circulation Pumps	0.0	0.0	0.0	0.0	0.0
Base Utilities	0.0	0.0	0.0	0.0	0.0
Subtotal	60,840.6	0.0	44.8	623,008.9	65.2
..hting	47,691.6	0.0	35.1	488,362.7	49.8
..ceptacle	0.0	0.0	0.0	0.0	0.0
Domestic Hot Water	0.0	0.0	0.0	0.0	0.0
Cogeneration	0.0	0.0	0.0	0.0	0.0
Totals	128,282.3	25,995.8	100.0	1,340,977.6	139.0

ECO B-17
SHEET 3 OF 5

CALIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 3
MZ-CRAC

-- CALIFORNIA TITLE 24 COMPLIANCE REPORT --

Weather Name .... PASOROBL
Gross Conditioned Floor Area (sqft)...... 9,800
ACM Multiplier 1.025

-- E N E R G Y U S E S U M M A R Y --

	ELEC (kWh/yr)	GAS (kBtu/yr)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	0.0	25,995.8	5.9	27,364.0	2.9
Primary Cooling					
Compressor	10,580.3	0.0	8.2	108,342.5	11.3
Tower/Cond Fans	2,243.8	0.0	1.7	22,976.4	2.4
Condenser Pump	0.0	0.0	0.0	0.0	0.0
Other Accessories	2,913.9	0.0	2.2	29,838.4	3.1
Auxiliary					
Supply Fans	58,547.8	0.0	45.2	599,531.3	62.7
Circulation Pumps	0.0	0.0	0.0	0.0	0.0
Base Utilities	0.0	0.0	0.0	0.0	0.0
Subtotal	58,547.8	0.0	45.2	599,531.3	62.7
Lighting	47,691.6	0.0	36.8	488,362.7	49.8
Receptacle	0.0	0.0	0.0	0.0	0.0
Domestic Hot Water	0.0	0.0	0.0	0.0	0.0
Cogeneration	0.0	0.0	0.0	0.0	0.0
Totals	121,977.4	25,995.8	100.0	1,276,415.3	132.3

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY BLH
DATE FEB 1992
REV. 19

ECO B-17
RELOCATE TRANSFORMER
CALCULATIONS

PROJECT 16-403-10
FTL FEAP
SHEET NO. 4 OF 5 SHEETS

ASSUME: 75 KW LOADING ON 150 KW XFMR.
- 96% EFFICIENT

REDUCTION OF AIRCONDITIONING LOAD = .04 x 75
= 1.8 KW

FROM TRACE 600 RUN:

ENERGY SAVINGS = 128,282.3 KWH/YR
- 121,977.4 KWH/YR

6,305 KWH/YR

ESTIMATED COST

RELOCATE XFMR	$900
RELOCATE SUB FLOOR CABLE	$1,500
	$2,400

SEE FOLLOWING ECIP FORM FOR SAVINGS

59 100
50 4080

FORM 101-1/8

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B17
Sheet 5 fo 5

Location: Fort Hunter Liggett, California
Project Title: Relocate Transformer, Building 301
Discrete Portion Name: ECO# B-17
Analysis Date: March 1993

Region No. 4

Economic Life: 20 YEARS

Project No. 16-403-10
Fiscal Year FY96

Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$2,400		
B. SIOH	$132		
C. Design Cost	$144		
D. Total Cost (1A+1B+1C)	$2,676		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$2,676

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	21.5	$392	14.53	$5,700
B. Dist	$4.96	0.0	$0	17.63	$0
C. Propane	$7.87	0.0	$0	18.59	$0
D. Demand	$106.60	1.8 k	$195	14.53	$2,840
E. Other					
F. Total			$588		$8,540

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		13.59	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 4.6 Years
5. Total Net Discounted Savings (2F5+3C): $8,540
6. Savings to Investment Ratio (SIR) 5/1G: 3.19
7. Adjusted Internal Rate of Return (AIRR): 21.50%

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY RJB
CHECKED BY RLH
DATE FEB 1993
REV. 19

ECO # B-18
ADD ZONE OPTIMIZER
PROJECT DESCRIPTION

PROJECT 16-403-10
FTL EEAP
SHEET NO. 1 OF 5 SHEETS

DESCRIPTION OF ACTION

ADD A ZONE OPTIMIZER OR DISCRIMINATOR TO THE CONTROLS ON THE THEATER AND THE CHAPEL. THIS WILL INSURE THAT THE COOLING SETPOINT IS ONLY LOW ENOUGH TO SATISFY THE ZONE WITH THE GREATEST LOAD. THIS WILL MINIMIZE THE AMOUNT OF REHEAT REQUIRED FOR THE OTHER ZONES AND ULTIMATLY BOTH HEATING AND COOLING LOADS WILL BE REDUCED.

CHAPEL BLDG 190

ENERGY SAVINGS:

20 KW x 1 HR/DAY x (7 DAYS/WEEK x 26 WEEKS/YR)

= 3,640 KWH/YR

THEATER BLDG 81

20 KW x 1/2 HR/DAY x (3 DAYS/WEEK x 26 WEEKS/YR)

= 780 KWH/YR

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RWB
CHECKED BY BH
DATE FEB 1993
REV. 19__

ECO# B-18
ADD ZONE OPTIMIZER
COST SAVINGS

PROJECT 16-403-10
FT. ERAP

SHEET NO. 2 OF 5 SHEETS

CHAPEL

3640 KWH/YR x .07454 $/KWH = $271/YR

15 YR SAVINGS = $271 x 11.70 = $3775.

THEATER

730 KWH/YR x .07454 $/KWH = $58/YR

15 YR SAVINGS = $58 x 11.70 = $679

COST

$1,000/BUILDING

SIR

THEATER = $3013/$1000 = 3

CHAPEL = $647/$1000 = .6

USE CHAPEL ONLY

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet	3 OF 5
Project	EEAP Limited Energy Study
Project No.	16-403-10
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO-B18 Zone Optimizer Control
Estimator	RJB
Checked By	BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
TYPICAL ZONE OPTIMIZER CONTRO							
Temperature Controller	1	Ea	$33.91	$34	$165	$165	$199
Temperature Sensor	3	Ea	$28.06	$84	$95	$286	$371
Relay	3	Ea	$47.63	$143	$62	$185	$328
Wiring	1	Job	$240	$240	$100	$100	$340
Subtotal, Optimizer Control							$1,238
Sales Tax 8%							$99
Contractor O.H. & P 30%							$99
Sub Total							$1,436
Bond 1%							$14
Sub Total							$1,450
Estimating Contingency 10%							$145
Total Probable Construction Cost							$1,595

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B18
Sheet 4 fo 5

Location: Fort Hunter Liggett, California
Project Title: Add Zone Optimizer Control
Discrete Portion Name: ECO# B-18, Bldg # 190
Analysis Date: March 1993

Region No. 4

Economic Life: 15 YEARS

Project No. 16-403-10
Fiscal Year FY96

Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$1,595		
B. SIOH	$88		
C. Design Cost	$96		
D. Total Cost (1A+1B+1C)	$1,778		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$1,778

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	12.4	$271	11.70	$3,169
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	0.0 k	$0	11.70	$0
E. Other					
F. Total			$271		$3,169

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 6.6 Years
5. Total Net Discounted Savings (2F5+3C): $3,169
6. Savings to Investment Ratio (SIR) 5/1G: 1.78
7. Adjusted Internal Rate of Return (AIRR): 12.70%

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO B18
Sheet 5 fo 5

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: Add Zone Optimizer Control — Fiscal Year FY96
Discrete Portion Name: ECO# B-18, Bldg 81
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$1,595		
B. SIOH	$88		
C. Design Cost	$96		
D. Total Cost (1A+1B+1C)	$1,778		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$1,778

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	2.7	$58	11.70	$680
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	0.0	$0	11.70	$0
E. Other					
F. Total			$58		$680

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	30.6	Years
5. Total Net Discounted Savings (2F5+3C):	$680	
6. Savings to Investment Ratio (SIR) 5/1G:	0.38	
7. Adjusted Internal Rate of Return (AIRR):	Negative	

Keller & Gannon

Engineers–Architects

COMPUTATION SHEET

COMPUTED BY B/H
CHECKED BY
DATE MARCH 1993
REV. 19

CONSOLODATE FOOD STORAGE
ECO B20

PROJECT 16-403-10
FHL EEAP

SHEET NO. 1 OF 1 SHEETS

In an energy audit conducted by PG&E in 1982, the following recommendation was made:

REFRIGERATION

15. Consolidate eating facility food storage.

Recommend: Consider consolidating food storage facilities for the various eating facilities. Due to the remoteness of the base, food shipments are made less frequently than normal, requiring larger storage capacity. Savings could be accomplished by retaining only enough refrigerated storage for daily consumption at each of the smaller eating facilities.

Projected Savings: 15 kw, 32,850 kwh/yr, $2,631.28/yr
Payback Period: Immediate

While this is an excellent concept, the practice of consolidated food storage will not be practical. Some of the reasons this idea will not work include:

- Eating Facilities include the Consolidated Dining Facility (B-206), the snack bar (B-209), Bowling Alley (B-121), Hacienda Resterant & Lounge (B-101). Each of these facilities is managed by a different entity; some are Army controlled, others are AFFES. The possibility of abuse exists and confusion/accounting and responsibilities would be impractible to arrange.
- A new cold storage facility has been built next to the new commissary (B-182) which consolidates several cold storage facilities that were distributed during the 1982 PG&E survey.

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY J CASE
CHECKED BY
DATE MARCH 1993
REV. 19

ECO B-21
BOILER OR BURNER REPLACEMENT

PROJECT 16-403-10
EEAP EHL

SHEET NO. 1 OF 21 SHEETS

DESCRIPTION OF ACTION

REMOVE EXISTING BURNERS ON BOILERS WITH LOW COMBUSTION EFFICIENCIES OR REPLACE BOILERS WITH HIGH RADIANT OR CONVECTIVE LOSSES. REPLACE WITH HIGH EFFICIENCY BURNERS OR NEW HIGH EFFICIENCY BOILER.

FACILITIES INCLUDED

REFER TO ATTACHED SPREADSHEET PRINTOUT.

ENERGY SAVING CALCULATIONS

THE FUEL USAGE OF THE EXISTING UNITS HAS BEEN SIMULATED USING TRACE 600 COMPUTER RUNS OR OTHER CALC. METHODS ALL USAGES HAVE BEEN VERIFIED WITH RECORDS OF FUEL DELIVERY. THE FIRING EFFICIENCIES OF THE NEW BURNERS AND BOILERS WERE OBTAINED FROM MANUF'S PUBLISHED DATA. THE EXISTING FIRING EFFICIENCIES WERE OBTAINED FROM ANNUAL EFFICENCY TEST RECORDS. OTHER LOSSES WERE BASED ON CONDITION OF BOILER AT THE TIME OF FIELD INSPECTION.

FORM 101-1/8

ECO B-21

HIGH EFFICIENCY BOILER CONVERSION

Fac No.	Installation Name	Boiler System Data			Existing Boiler System Losses						
		Fuel Used	System Type	Capacity BTUH	Firing Eff	Auxiliary	Radiant	Convection	Shut-Down	General	Net Eff
P 101	Open Din Conc (Hacienda) Club (Bar)	Propane	AHU-HWB/CW	300,000	82.9%	-	6.0%	4.0%	2.0%	3.0%	67.9%
	Hacienda, Dwellings	Electric	ER-PH	30 x 3kW=90kW	-	-	-	-	-	-	-
P 128	Officers Quarters Military	Propane	FCU-HWB/CW	567,000	89.0%	-	8.0%	4.0%	2.0%	2.0%	73.0%
S 197	Admin Bldg R&D - Office	Propane	AHU-PROP/DX	264,000+	86.0%	-	8.0%	5.0%	2.0%	2.0%	69.0%
	Admin Bldg R&D - Electronics	Electric	Wind Ac + ER	30kW Ht, 2x1.5R	-	-	-	-	-	-	-
P 209	AAFES Snack Bar	Propane	RTAHU-HWB/DX	280,000	77.2%	-	6.0%	5.0%	2.0%	3.0%	61.2%
P 252	Vehicle Maint Shop DS	Fuel Oil	HWB-UH/R	650,000	84.0%	-	4.0%	3.0%	2.0%	2.0%	73.0%
P 256	Vehicle Maint Shop ORG	Fuel Oil	HWB-UH/R	270,000	82.7%	-	4.0%	3.0%	2.0%	2.0%	71.7%
P 259	Vehicle Maint Shop ORG	Fuel Oil	HWB-UH/R	650,000	84.9%	-	4.0%	3.0%	2.0%	2.0%	73.9%
S 290	Electron Equip Facility	Propane	AHU-PROP/CW	1,020,000	80.8%	-	8.0%	4.0%	2.0%	3.0%	63.8%
		Electric	Window AC/ER	36.8 kW	-	-	-	-	-	-	-
S 291	Cont Humid Warehouse	Propane	AHU-STM/DX	1,020,000	78.8%	3.0%	7.0%	4.0%	2.0%	3.0%	59.8%
P 295	Enl Barracks w/o Dining	Propane	FCU-HWB/CW	3,250,000	77.7%	-	8.0%	5.0%	2.0%	3.0%	59.7%
P 642	Detached Latrine/Shower	Propane	HWH/TK-Circ	180,000	75.2%	-	7.0%	4.0%	2.0%	3.0%	59.2%

3 OF 21
ECO B-21

HIGH EFFICIENCY BOILER CONVERSION

Fac No.	Installation Name	New Boiler System Losses										
		Firing Eff	Auxi-liary	Radiant	Convection	Shut-Down	General	Net Eff	Effiency Increase	Energy Usage (MBTU/YR)	Energy Savings (MBTU/YR)	Annual Cost Savings ($)
P 101	Open Din Cons (Hacienda)	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	17.1%	1064	214	$1,685
	Club (Bar)											
	Hacienda, Dwellings	-	-	-	-	-	-	-				
P 128	Officers Quarters Military	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	12.0%	636.9	90	$708
S 197	Admin Bldg R&D - Office	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	16.0%	262.4	49	$388
	Admin Bldg R&D - Electronics	-	-	-	-	-	-	-				
P 209	AAFES Snack Bar	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	23.8%	84.8	24	$187
P 252	Vehicle Maint Shop DS	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	12.0%	900.5	127	$998
P 256	Vehicle Maint Shop ORG	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	13.3%	403	63	$498
P 259	Vehicle Maint Shop ORG	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	11.1%	989.9	130	$1,020
S 290	Electron Equip Facility	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	21.2%	741.5	185	$1,455
		-	-	-	-	-	-	-				
S 291	Cont Humid Warehouse	94.0%	3.0%	4.0%	2.0%	2.0%	1.0%	85.0%	25.2%	375.2	111	$874
P 295	Enl Barracks w/o Dining	94.0%	-	4.0%	2.0%	2.0%	1.0%	85.0%	25.3%	1014.5	302	$2,380
P 642	Detached Latrine/Shower	0.94		0.04	0.02	2.0%	1.0%	85.0%	25.9%	116.7	107	$843
							Totals of Succesfull Repacements				916	$7,206

HIGH EFFICIENCY BOILER CONVERSION

Fac No.	Installation Name	LCC Savings ($)	Capitol Cost ($)	SIR
P 101	Open Din Cons (Hacienda) Club (Bar) Hacienda, Dwellings	$23,854	$6,941	3.4
P 128	Officers Quarters Military	$10,020	$10,217	1.0
S 197	Admin Bldg R&D - Office Admin Bldg R&D - Electronics	$5,493	$6,364	0.9
P 209	AAFES Snack Bar	$2,650	$6,364	0.4
P 252	Vehicle Maint Shop DS	$14,128	$12,557	1.1
P 256	Vehicle Maint Shop ORG	$7,045	$6,364	1.1
P 259	Vehicle Maint Shop ORG	$14,449	$12,557	1.2
S 290	Electron Equip Facility	$20,609	$15,793	1.3
S 291	Cont Humid Warehouse	$12,380	$15,795	0.8
P 295	Enl Barracks w/o Dining	$33,695	$36,188	0.9
P 642	Detached Latrine/Shower	$11,934	$5,327	2.2
		$102,039	$69,756	1.5

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 5 Of 21

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 101

Estimator:

Checked By:

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing boiler	1	EA	$750	$750		$0	$750
Provide & Install 300,000 btuh boiler	1	EA	$1,050	$1,050	$2,650	$2,650	$3,700
Subtotal							$4,450
Sales Tax @ 8%							$356
Subtotal							$4,806
Contractor OH & Profit @ 30%							$1,442
Subtotal							$6,248
Bond @ 1%							$62
Subtotal							$6,310
Estimating Contingency @ 10%							$631
Total Probable Construction Cost							$6,941

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 6 Of 21

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 128

Estimator:

Checked By:

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing boiler	1	EA	$850	$850		$0	$850
Provide & Install 570,000 btuh boiler	1	EA	$1,400	$1,400	$4,300	$4,300	$5,700
Subtotal							$6,550
Sales Tax @ 8%							$524
Subtotal							$7,074
Contractor OH & Profit @ 30%							$2,122
Subtotal							$9,196
Bond @ 1%							$92
Subtotal							$9,288
Estimating Contingency @ 10%							$929
Total Probable Construction Cost							$10,217

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet 7 Of 21	
Project	EEAP Limited Energy Study
Project No.	
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO B-21, REPLACE BOILERS, BLDG 197
Estimator	
Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing boiler	1	EA	$750	$750		$0	$750
Provide & Install 264,000 btuh boiler	1	EA	$930	$930	$2,400	$2,400	$3,330
Subtotal							$4,080
Sales Tax @ 8%							$326
Subtotal							$4,406
Contractor OH & Profit @ 30%							$1,322
Subtotal							$5,728
Bond @ 1%							$57
Subtotal							$5,786
Estimating Contingency @ 10%							$579
Total Probable Construction Cost							$6,364

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 8 Of 21

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 209

Estimator:

Checked By:

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing boiler	1	EA	$750	$750		$0	$750
Provide & Install 280,000 btuh boiler	1	EA	$930	$930	$2,400	$2,400	$3,330
Subtotal							$4,080
Sales Tax @ 8%							$326
Subtotal							$4,406
Contractor OH & Profit @ 30%							$1,322
Subtotal							$5,728
Bond @ 1%							$57
Subtotal							$5,786
Estimating Contingency @ 10%							$579
Total Probable Construction Cost							$6,364

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 9 Of 21

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 252

Estimator:

Checked By:

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing oil boiler	1	EA	$1,000	$1,000		$0	$1,000
Provide & Install 650,000 btuh boiler	1	EA	$1,525	$1,525	$5,525	$5,525	$7,050
Subtotal							$8,050
Sales Tax @ 8%							$644
Subtotal							$8,694
Contractor OH & Profit @ 30%							$2,608
Subtotal							$11,302
Bond @ 1%							$113
Subtotal							$11,415
Estimating Contingency @ 10%							$1,142
Total Probable Construction Cost							$12,557

CONSTRUCTION COST ESTIMATE		Date Prepared February 1993	Sheet 10 Of 21
Project EEAP Limited Energy Study	Project No.	Basis for Estimate Code A (no design competed)	
Location Fort Hunter-Liggett, California			
Engineer-Architect Keller & Gannon			
Drawing No. ECO B-21, REPLACE BOILERS, BLDG 256	Estimator	Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing oil boiler	1	EA	$750	$750		$0	$750
Provide & install 270,000 btuh boiler	1	EA	$930	$930	$2,400	$2,400	$3,330
Subtotal							$4,080
Sales Tax @ 8%							$326
Subtotal							$4,406
Contractor OH & Profit @ 30%							$1,322
Subtotal							$5,728
Bond @ 1%							$57
Subtotal							$5,786
Estimating Contingency @ 10%							$579
Total Probable Construction Cost							$6,364

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993	Sheet 11	Of 21

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 259

Estimator:

Checked By:

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Demolish existing oil boiler	1	EA	$1,000	$1,000		$0	$1,000
Provide & Install 650,000 btuh boiler	1	EA	$1,525	$1,525	$5,525	$5,525	$7,050
Subtotal							$8,050
Sales Tax @ 8%							$644
Subtotal							$8,694
Contractor OH & Profit @ 30%							$2,608
Subtotal							$11,302
Bond @ 1%							$113
Subtotal							$11,415
Estimating Contingency @ 10%							$1,142
Total Probable Construction Cost							$12,557

CONSTRUCTION COST ESTIMATE				Date Prepared: February 1993		Sheet 12 Of 21	
Project: EEAP Limited Energy Study				Project No.		Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California							
Engineer-Architect: Keller & Gannon							
Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 290			Estimator			Checked By	

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing boiler	1	EA	$1,200	$1,200		$0	$1,200
Provide & Install 1,020,000 btuh boiler	1	EA	$1,675	$1,675	$7,250	$7,250	$8,925
Subtotal							$10,125
Sales Tax @ 8%							$810
Subtotal							$10,935
Contractor OH & Profit @ 30%							$3,281
Subtotal							$14,216
Bond @ 1%							$142
Subtotal							$14,358
Estimating Contingency @ 10%							$1,436
Total Probable Construction Cost							$15,793

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 13 Of 21
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 291	Estimator	Checked By

Line Item	Quantity: No. Units	Quantity: Unit Meas.	Labor: Per Unit	Labor: Total	Material: Per Unit	Material: Total	Total Cost
Demolish existing boiler	1	EA	$1,200	$1,200		$0	$1,200
Provide & Install 1,020,000 btuh boiler	1	EA	$1,675	$1,675	$7,250	$7,250	$8,925
Subtotal							$10,125
Sales Tax @ 8%							$810
Subtotal							$10,935
Contractor OH & Profit @ 30%							$3,281
Subtotal							$14,216
Bond @ 1%							$142
Subtotal							$14,358
Estimating Contingency @ 10%							$1,436
Total Probable Construction Cost							$15,793

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 14 Of 21
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 295	Estimator	Checked By

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Demolish existing boiler	1	EA	$1,500	$1,500		$0	$1,500
Provide & Install 3,250,000 btuh boiler	1	EA	$2,800	$2,800	$18,900	$18,900	$21,700
Subtotal							$23,200
Sales Tax @ 8%							$1,856
Subtotal							$25,056
Contractor OH & Profit @ 30%							$7,517
Subtotal							$32,573
Bond @ 1%							$326
Subtotal							$32,899
Estimating Contingency @ 10%							$3,290
Total Probable Construction Cost							$36,188

CONSTRUCTION COST ESTIMATE

Date Prepared: February 1993

Sheet 15 Of 21

Project: EEAP Limited Energy Study

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Fort Hunter-Liggett, California

Engineer-Architect: Keller & Gannon

Drawing No.: ECO B-21, REPLACE BOILERS, BLDG 642

Estimator:

Checked By:

Line Item	Quantity: No. Units	Quantity: Unit Meas.	Labor: Per Unit	Labor: Total	Material: Per Unit	Material: Total	Total Cost
Demolish existing boiler	1	EA	$750	$750		$0	$750
Provide & Install 180,000 btuh boiler	1	EA	$840	$840	$1,825	$1,825	$2,665
Subtotal							$3,415
Sales Tax @ 8%							$273
Subtotal							$3,688
Contractor OH & Profit @ 30%							$1,106
Subtotal							$4,795
Bond @ 1%							$48
Subtotal							$4,843
Estimating Contingency @ 10%							$484
Total Probable Construction Cost							$5,327

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO C9
Sheet 16 of 21

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: Replace Low Efficiency Boilers
Fiscal Year FY96
Discrete Portion Name: ECO# B-21
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$69,756		
B. SIOH	$3,837		
C. Design Cost	$4,185		
D. Total Cost (1A+1B+1C)	$77,778		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$77,778

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	0.0	$0	11.70	$0
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	915.7	$7,206	14.16	$102,039
D. Demand	$108.60	0.0 k	$0	11.70	$0
E. Other					
F. Total			$7,206		$102,039

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

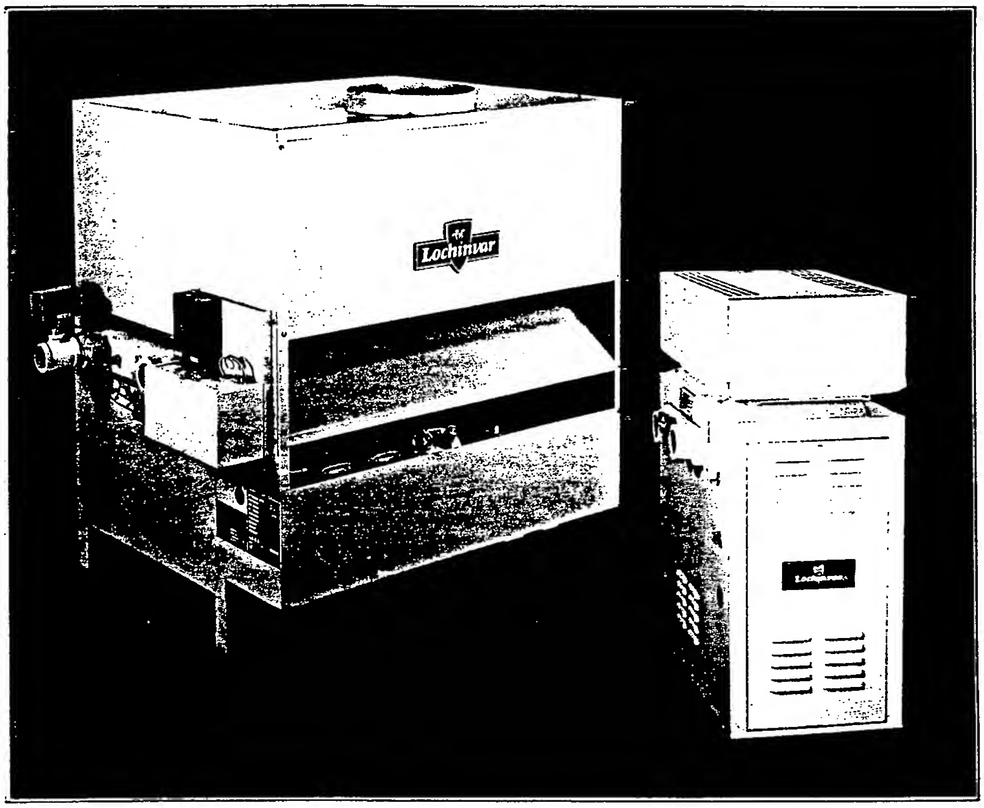
Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	10.8	Years
5. Total Net Discounted Savings (2F5+3C):	$102,039	
6. Savings to Investment Ratio (SIR) 5/1G:	1.31	
7. Adjusted Internal Rate of Return (AIRR):		

17 OF 21
ECO B-21

Copper-Fin® Boilers



Lochinvar

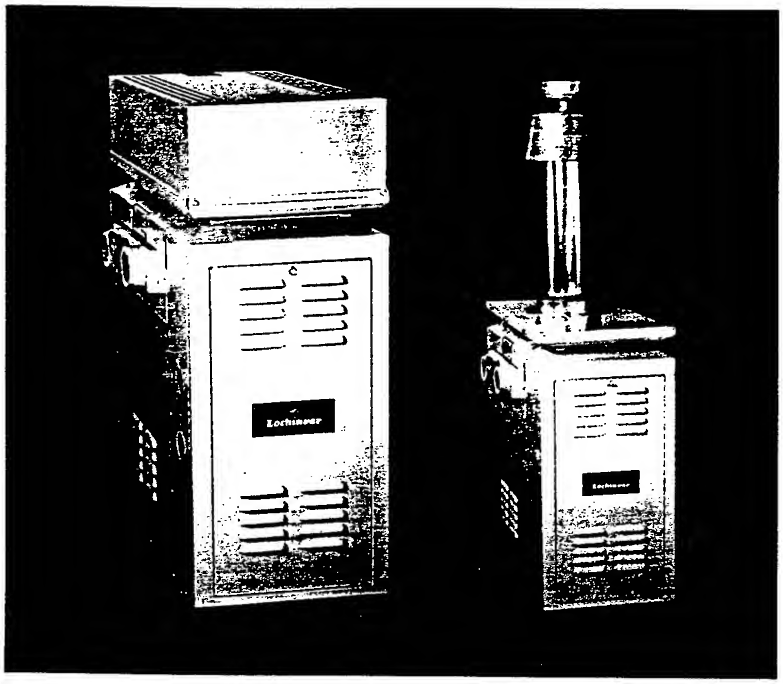
COPPER-FIN®—the energy efficient concept for today—and tomorrow!

- 22 models—capacities to 3,080,000 BTU—a size for every application
- Boiler design provides total protection from thermal shock
- Fin tube heat exchanger provides scale free performance
- Immediate response to heating demands
- Compact, lightweight construction
- A complete range of firing control and safety options
- Easily the most servicable Boiler on the market

Meets ASHRAE 90A-1980 Energy Efficiency Standards.

18 OF 21
ECO B-21

70,000 Thru 355,000 BTU



Standard Equipment

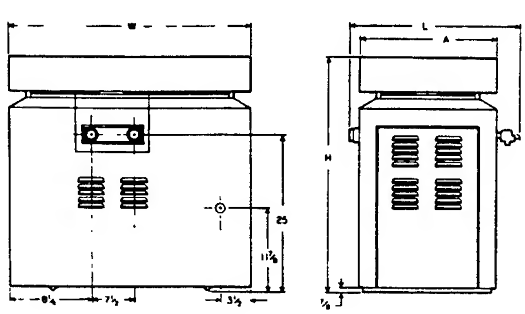
- Dial type temperature, pressure and altimeter gauge.
- Copper fin tubes.
- Atmospheric burners.
- Master on-off switch.
- Redundant gas valve.
- Adjustable high limit.
- ASME pressure relief valve— 30 PSI.
- Indoor or outdoor installation.
- 24 volt control system with transformer.
- Adjustable aquastat.
- Combination gas valve.
- Slideout burner tray.
- Completely enclosed controls.
- Thermocouple supervised pilot, 100% shut-off.

Optional Equipment

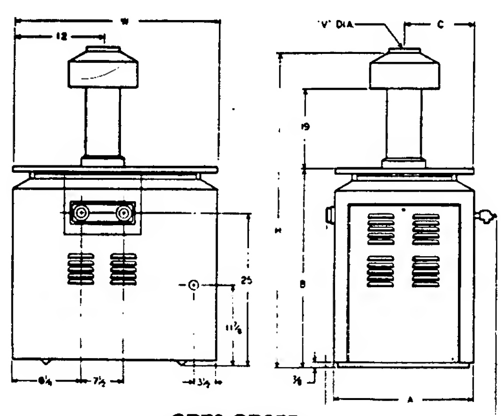
■ Intermittent pump controller ■ Cupro-nickel heat exchanger ■ Indoor/outdoor control ■ Low water cut-off ■ Flow switch ■ Modusnap valve ■ High/low gas pressure safety switch ■ Alarm Bell—120V ■ Manual reset high limit ■ Module-Pak sequence firing ■ Thermometer

Model Number	BTU Input	BTU Output	Min. Pipe Size	Gas Conn. Size	"H" Height	"W" Width	"L" Length	"V" Vent	"A"	"B"	"C"	Weight
Indoor Models												
CB70	72,000	57,600	2"	½"	57⅜	28	17	4	12	32⅜	6	185
CB110	108,000	86,400	2"	½"	58¼	28	19	5	14	32⅜	7	195
CB150	144,000	115,200	2"	½"	59	28	20½	6	15½	32⅜	7¾	210
CB215	216,000	172,800	2"	½"	60	28	24	7	19	32⅜	9½	232
CB255	252,000	201,600	2"	¾"	61¼	28	26	8	21	32⅜	10½	251
CB355	355,000	284,000	2"	¾"	61½	28	32	9	27	32⅜	13½	292
Outdoor Models												
CB70	72,000	57,600	2"	½"	39⅜	28	17	—	12	—	—	185
CB110	108,000	86,400	2"	½"	39⅜	28	19	—	14	—	—	195
CB150	144,000	115,200	2"	½"	39⅜	28	20½	—	15½	—	—	210
CB215	216,000	172,800	2"	½"	39⅜	28	24	—	19	—	—	232
CB255	252,000	201,600	2"	¾"	39⅜	28	26	—	21	—	—	251
CB355	355,000	284,000	2"	¾"	39⅜	28	32	—	27	—	—	292

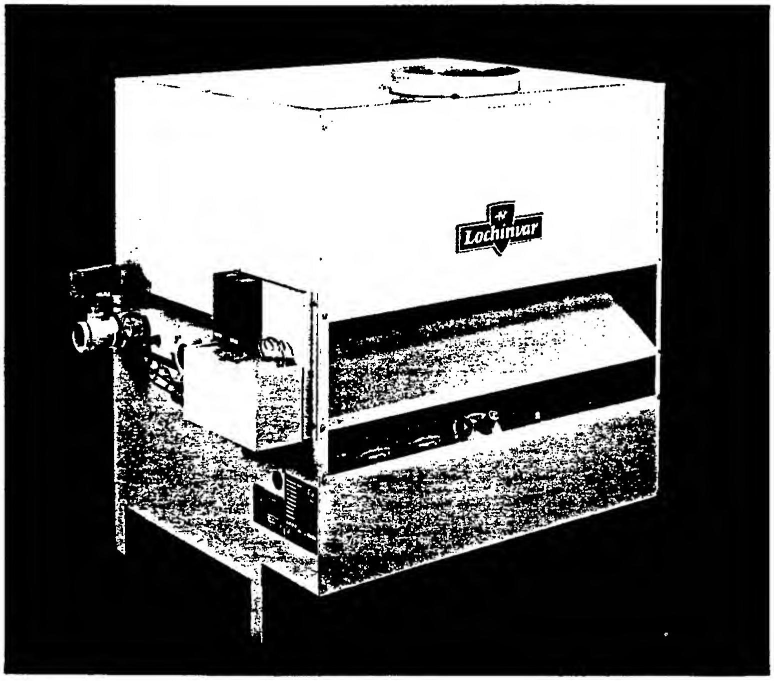
NOTES: 1. NOTE: LP gas models maintain full rated input—no derating required on these models.
2. Capacity ratings are actual heater performance at 80% combustion efficiency.



**CB70-CB355
OUTDOOR MODEL**



**CB70-CB355
INDOOR MODEL**



Standard Equipment

- Dial type temperature, pressure and altimeter gauge.
- Copper fin tubes.
- Atmospheric burners.
- Redundant gas valve.
- Adjustable high limit.
- ASME pressure relief valve—50 PSI.
- Spark ignition. (CB475-CB3080)
- 24 volt controls.
- Built-in draft diverter.
- Off/On switch with indicator light.
- Removable burner tray.
- Enclosed control panel.
- Adjustable aquastat.
- Main gas pressure regulator and pilot regulator.
- Manually operated main gas cock and pilot gas cock.
- Low Water Cut-Off (probe type). (CB1540-CB3080)
- Module Firing—Standard on models CB1700 and above.
- Leak test gas cock. (CB1540-CB3080)
- Flow switch. (CB1540-CB3080)

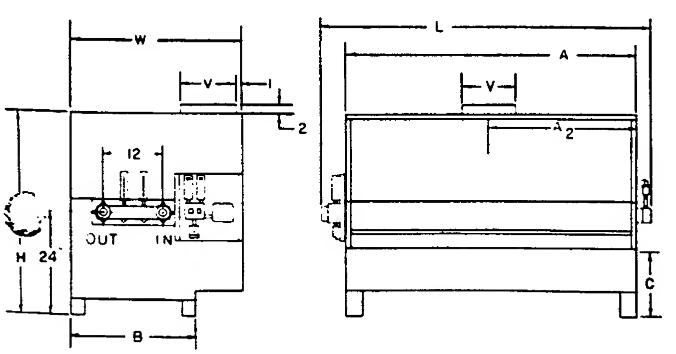
Optional Equipment

■ Intermittent pump controller ■ Cupro-nickel heat exchanger ■ Indoor/outdoor control ■ Low water cut-off ■ Flow switch ■ Modulating gas valve ■ High/low gas pressure safety switch ■ Alarm Bell—120V ■ Manual reset high limit ■ Module-Pak sequence firing ■ Additional solenoid gas valves ■ Motorized gas valve ■ Thermometer

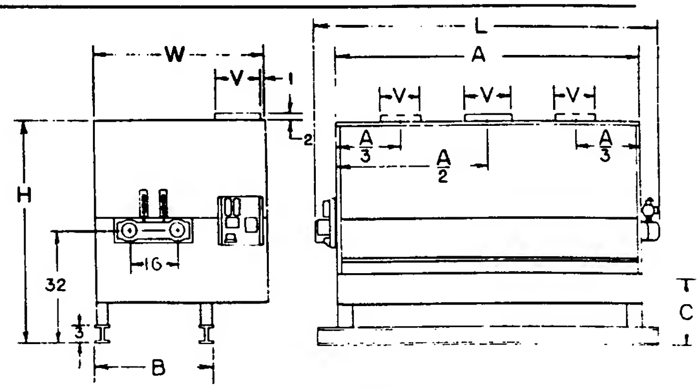
MODEL	BTU Input Natural Gas	BTU Output Natural Gas	Gas Conn. Size	DIMENSIONS V Vent	L † Length	W † Width	H Height	A	B	C Gas Inlet	Ship Wgt.
CB380	DISCONTINUED										
CB475	475,000	380,000	1	10	43	35½	47	35½	26½	14	692
CB570	570,000	456,000	1	12	48	35½	47	40½	26½	14	756
CB665	665,000	532,000	1	12	53	35½	47	45½	26½	14	820
CB760	760,000	608,000	1	14	58	35½	47	50½	26½	14	884
CB855	855,000	684,000	1	14	63	35½	47	55½	26½	14	948
CB940	940,000	752,000	1	14	68	35½	47	60½	26½	14	1012
CB1120	1,118,400	894,000	1¼	16	78	35½	47	70½	26½	14	1180
CB1210	1,206,400	965,000	1¼	16	83	35½	47	75½	26½	14	1238
CB1350	1,350,000	1,080,000	1¼	18	93	35½	47	85½	26½	14	1300
CB1540	1,540,000	1,232,000	1½	18	72¼	57	67⅝	65⅜	35½	11	1360
CB1700	1,694,000	1,355,200	2	20	77½	57	67⅝	70⅝	35½	11	1420
CB2000	2,002,000	1,601,600	2	20	88	57	67⅝	81⅛	35½	11	1660
CB2310	2,310,000	1,848,000	2	2-16	98½	57	67⅝	91⅝	35½	11	1900
CB2620	2,618,000	2,094,400	2	2-18	109	57	67⅝	102⅛	35½	11	2140
CB3080	3,080,000	2,464,000	2	2-18	124¾	57	67⅝	117⅞	35½	11	2500

NOTES: 1. For L.P. gas models, reduce input and recovery 12%.
2. Capacity ratings are actual heater performance at 80% combustion efficiency.

†Dimensions are for models equipped with standard firing control systems.



CB380-CB1350



CB1540-CB3080

Temperature Rise Chart

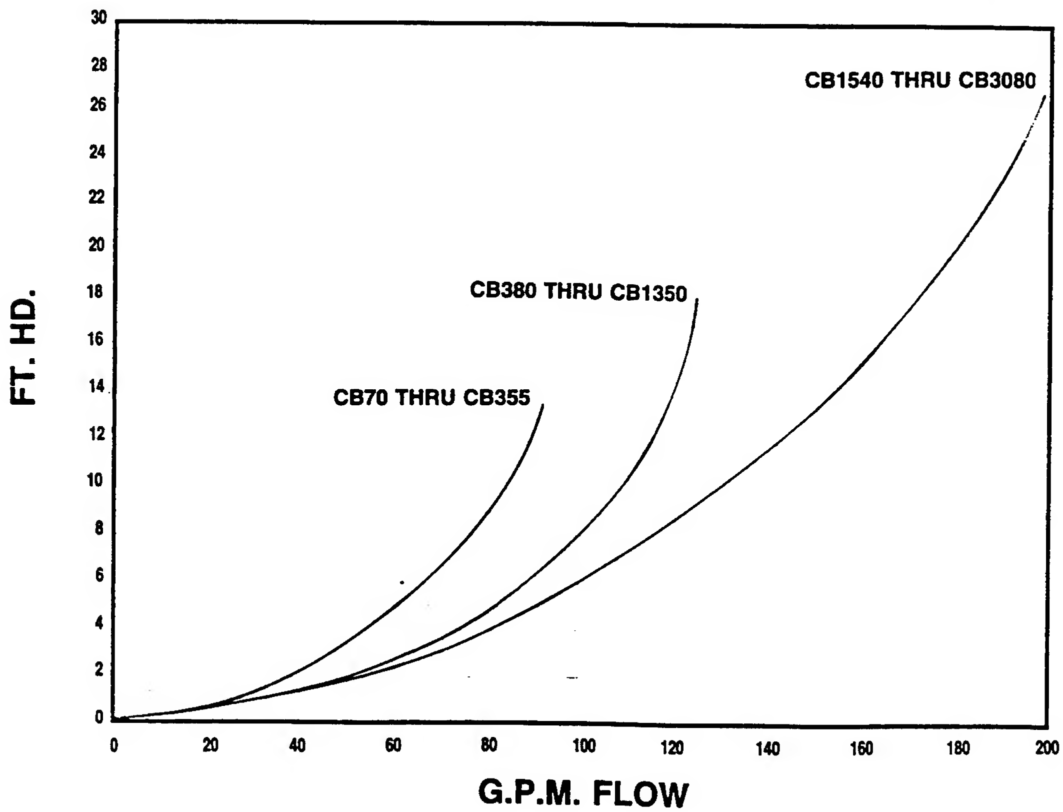
Eco B-21

Model No.	Input	Output	ΔT 10°		ΔT 20°		ΔT 30°		ΔT 40°		ΔT 50°		ΔT 60°	
			GPM	FT. HD	GPM	FT. HD	GPM	FT. HD	GPM	FT. HD	GPM	FT. HD	GPM	FT. HD
CB-70	72,000	57,600	11.52	0.2	5.76	0.05								
CB-110	108,000	86,400	17.29	0.5	8.64	0.15	5.76	.045						
CB-150	144,000	115,000	23.05	0.8	11.52	0.2	7.68	.085	5.76	.05				
CB-180	180,000	144,000	28.81	1.2	14.41	0.29	9.60	0.14	7.20	.08				
CB-215	216,000	172,800	34.58	1.7	17.29	0.5	11.52	0.2	8.64	0.11				
CB-255	252,000	201,600	40.34	2.3	20.17	0.61	13.44	0.28	10.08	0.15				
CB-355	355,000	284,000	56.83*	4.9	28.41	1.2	18.94	0.55	14.21	0.3				
CB-380	DISCONTINUED													
CB-475	475,000	380,000	76	4	38	1.5	25	1						
CB-570	570,000	456,000	91	6	46	2	30	1	23	1				
CB-665	665,000	532,000	106*	6†	53	2.5	36	1.5	27	1				
CB-760	760,000	608,000	122*	6†	61	2.5	41	1.5	30	1	24	1		
CB-855	855,000	684,000	137*	6†	68	3	46	1.5	34	1	27	1	23	1
CB-940	940,000	752,000	151*	6†	75	4	50	2	38	1.5	30	1	25	1
CB-1120	1,120,000	894,000	179*	6†	89	6	60	2.5	45	1.5	36	1.5	30	1
CB-1210	1,210,000	965,000	193*	6†	97*	8†	64	3	48	2	39	1.5	37	1
CB-1350	1,350,000	1,080,000	216*	6†	108*	10†	72	3.5	54	2	43	1.5	36	1.5
CB-1540	1,540,000	1,232,000	247*	11†	123*	11†	82	4	62	2.5	49	2	41	1.5
CB-1700	1,700,000	1,355,000	271*	11†	136*	11†	90	5	68	3	54	2	45	1.5
CB-2000	2,000,000	1,601,000	321*	11†	160*	11†	107	6.5	80	4	64	2.5	53	2
CB-2310	2,310,000	1,848,000	370*	11†	185*	11†	123	9	92	5	74	3	62	2.5
CB-2620	2,620,000	2,094,000	419*	11†	210*	11†	140*	11†	105	6.5	84	4	70	3
CB-3080	3,080,000	2,464,000	493*	11†	247*	11†	164*	11†	123	9	99	6	82	4

* FLOW RATE EXCEEDS RECOMMENDED FLOW RATES OF THE BOILER. IF THESE SYSTEM TEMPERATURE RISES ARE USED, AN EXTERNAL PIPING BY-PASS SHOULD BE INSTALLED AS SHOWN IN FIG. 1 (AT RIGHT).

† FOOT HEAD CALCULATIONS FOR MAXIMUM ALLOWABLE FLOW RATE OF BOILER.

Pressure Drop—Lochinvar Copper-Fin® CB Boilers



Typical Specification

BOILER—The hot water boiler shall be LOCHINVAR COPPER-FIN MODEL CB_________, having an input rating of __________BTU/HR input and __________BTU/HR output.

The water containing section shall be of the "fin-tube," 2 pass design, with straight solid copper tubes having extruded integral fins spaced 7 fins per inch. Tubes shall be securely rolled into glass-coated, cast iron headers with inspection coverplates removable from either end of the heat exchanger for purposes of inspection, cleaning, or repair. Heat exchanger shall be mounted on a stress-free steel framework (Models CB380-3080) in order to provide a "free-floating" design, able to withstand the effects of thermal shock. Heat exchanger shall carry a five year limited warranty against failure caused by defective workmanship or material.

The boiler shall bear the ASME "H" stamp and shall be National Board listed for 160# working pressure. The combustion chamber shall be enclosed by high temperature resistant, spall-proof refractory, which shall be modular for ease of replacement in sections. Boiler shall be constructed with a 16 gauge jacket, galvanized inside and outside, and protected with a 3 coat acrylic finish. Boilers CB380-3080 shall have a built-in draft diverter contained entirely within the jacket, and requiring no additional external drafthood devices. Models CB70-355 shall be available with either indoor or outdoor vent kits (specify). The boiler shall contain 3½ inches of high density fiberglass insulation.

Standard controls and equipment shall include: Copper fin tubes, atmospheric ribbon-type burners of aluminized steel, 100% safety pilot shutdown, control aquastat, electric hi-limit, redundant gas valves, manual gas cock, main and pilot gas pressure regulators, master switch, ASME pressure relief valve. Boiler shall meet the energy efficiency standards of ASHRAE 90A-1980. Boiler shall be A.G.A. or U.L. approved and listed.

The Firing Control System shall be___________, (options below). Prefix "F" denotes standard on/off firing; prefix "M" denotes module firing.

F1	Standard equipment for Models CB70-CB380. Thermocouple supervision, standing pilot.
F9	Standard equipment for CB475 through CB1540. Electronic pilot supervision, spark ignition. 4 second main gas shutdown.
M9	Standard equipment on CB1700 through CB3080. Electronic pilot supervision, spark ignition. 4 second main gas shutdown.
F3/M3	FM approved system.
F4/M4	IRI (formerly FIA).
F5/M5	Illinois School Code.
F6/M6	Improved Risks Mutual (IRM).
F7/M7	California Code.
F9/M9	Includes spark ignition, electronic pilot supervision, 4 second main gas shutdown.

BURNER MODULATION (OPTIONS A & B)

A) Boiler shall be module fired to effect peak fuel efficiency. Module firing shall employ dual gas controls, gas valves, and aquastats, with an overriding hi-limit safety control. With aquastat settings a few degrees apart, upon a call for heat, 50% of the boiler input will be fired. Where the demand cannot be met in this mode, the remaining 50% of boiler input shall be fired automatically to reach the full rated input of the boiler. Boiler shall be capable of 100% on/off firing.

B) Boiler shall have a motor operated modulating gas valve capable of regulating the input rating of the boiler proportionate to the heating demand. Full modulation permits boiler operation from 100% of rated input down to approximately 20% of rated input, in order to effect greater boiler and system efficiency.

NOTE: Module firing systems are available with all firing control packages.

Boiler Design (CB70-CB1380) certified by A.G.A. as hot water boilers for both Natural and Propane Gas.

Boiler Design (CB1540-CB3080) listed by Underwriters Laboratories as heating boilers for both Natural and Propane Gas.

All models comply with ASME Boiler Code for 160 psi working pressure and registered by National Board.

gama

Lochinvar

Lochinvar Water Heater Corporation
Nashville, Tennessee 37210 □ (615) 889-8900
Telex Number 55-5161 □ FAX: 615-885-4403
Detroit, Michigan 48227 □ (313) 273-9500
FAX: 313-273-4328
Dallas, Texas 75234 □ (214) 484-8677
FAX: 214-247-1411

AAD-5M-8/87
Printed in U.S.A.

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY B/H
CHECKED BY
DATE MARCH 1993
REV. 19

ECO C1
REDUCE DHW TEMPS

PROJECT 16-403-10
FHL-EEAP

SHEET NO. 1 OF 7 SHEETS

DESCRIPTION OF WORK

REDUCE DHW TEMPERATURES TO AUTHORIZED LEVES PER FORT ORD REGULATION 11-2

BUILDINGS INCLUDED

REFER TO ATTACHED PRINT-OUTS

ENERGY SAVING CALCULATIONS

TEMPERATURES WERE REDUCED FROM THOSE MEASURED DURING FIELD INVESTIGATIONS. THESE TEMPERATURES WERE THEN USED TO CALCULATE DHW ENERGY USE FOLLOWING THE SAME PROCEDURE AS FOR DETERMINING BASELINE DHW ENERGY USE. REFER TO APPENDIX B.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H
CHECKED BY
DATE MARCH 1993
REV. 19

ECO #C1
REDUCE DHW TEMPS

PROJECT 16-403-10
FHL - EEAP

SHEET NO. 2 OF 7 SHEETS

CONSTRUCTION COSTS

NO CONSTRUCTION IS REQUIRED, RATHER, RESET DHW HEATER / HEATING SYSTEM SETPOINTS ANNUALLY.

NOT ALL BLDGS SHOW ENERGY SAVINGS. HOWEVER, EQUIPMENT MUST BE RESET ANNUALLY ON ALL BLDGS. FOR THE ECO TO BE SUCCESSFUL.

ALLOWING FOR TRAVEL TIME BETWEEN BUILDINGS, EXPENSE 1/2 HOUR @ $40/HR PER YEAR PER BLDG SERVED BY DHW.

$40
PLUS 8% TAX
30% CONTR. OH&P
1% BOND
~~5.5 %~~
10% CONTINGENCY
} COMPOUNDING
5.5% SIOH
6% DESIGN
} ADDATIVE

$69.57 per Bldg (or dwelling address) / year.

ASSUMED 15 YEAR PROGRAM

INITIAL INVESTMENT $69.57 / BLDG with DHW

EXPENSED EACH OF 15 YEARS USING UPW FACTOR 11.12 (NON-ENERGY).

OVERALL SIR = 2.14

FORM 101-1/8

ECO C-1 Sheet 3 of 7

Fac No.	Installation Name	DHW Temperatures ECO C Temp	Actual Temp	Authorized Temp	ECO C1 Energy Savings Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Investment
T 6	Family Housing NCO & Enl	135	135	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 41A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 41B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 42A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 42B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 43A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 43B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 44A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 44B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 45A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 45B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 46	Family Housing CG & WO	140	145	140	-	1.80	-	$0	$14	$0	$200	$69.57
P 47	Family Housing CG & WO	140	145	140	-	1.80	-	$0	$14	$0	$200	$69.57
P 51A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 51B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 52A	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 52B	Family Housing NCO & Enl	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 53	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 54	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 55	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 56	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 57	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 58	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 59	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
P 60	Family Housing CG & WO	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
S 79	Post Office, Main	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 80	Exchange, Main Retail	105	135	105	-	-	6.35	$0	$0	$395	$4,621	$69.57
P 81	Theater with Dressing Rm's	105	135	105	-	-	15.58	$0	$0	$969	$11,343	$69.57
P 101	Open Din Cons (Hacienda)	140	160	140	-	19.40	-	$0	$153	$0	$2,162	$69.57
	Club (Bar)	105	140	105	-	9.95	-	$0	$78	$0	$1,109	$69.57
	Hacienda, Dwellings	105	140	105	-	37.89	-	$0	$298	$0	$4,222	$69.57
		140	140	140	-	9.12	-	$0	$72	$0	$1,017	$69.57
P 116	Exchange Service Station	105	120	105	-	-	0.16	$0	$0	$10	$119	$69.57
	(Non-shop areas)	NA		105	-	-	-	$0	$0	$0	$0	-
T 120	Fire Station - Office	105	110	105	-	0.35	-	$0	$3	$0	$39	$69.57
	Fire Station - Dorm	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
	Fire Station - Garage	NA		105	-	-	-	$0	$0	$0	$0	-

ECO C-1 Sheet 4 of 7

Fac No.	Installation Name	DHW Temperatures ECO C Temp	Actual Temp	Authorized Temp	ECO C1 Energy Savings Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Investment
T 121	Bowling Center	105	121	105	-	10.68	-	$0	$84	$0	$1,190	$69.57
		105	142	105	-	-	1.23	$0	$0	$77	$899	$69.57
T 124	Family Housing LC & MJ	140	160	140	-	17.75	-	$0	$140	$0	$1,978	$69.57
T 127	Officers Quarters Military	105	128	105	-	24.48	-	$0	$193	$0	$2,728	$69.57
P 128	Officers Quarters Military	140	140	140	-	0.00	-	$0	$0	$0	$0	$69.57
T 131	Family Housing CG & WO	140	135	140	-	(4.44)	-	$0	($35)	$0	($495)	$69.57
S 144	Gymnasium	NA	NA	105	-	-	-	$0	$0	$0	$0	-
S 146	FE Facility	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 149	Family Housing NCO & Enl	135	135	140	-	0.00	-	$0	$0	$0	$0	$69.57
T 156	FE Facility - Shop	105	140	105	-	-	0.34	$0	$0	$21	$245	$69.57
	FE Facility - Office	NA		105	-	-	-	$0	$0	$0	$0	-
T 158	Vehicle Storage	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 161	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 162	Elec Maint. Shop	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 163	Officers Quarters Military	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 164	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 165	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 166	Officers Quarters Military	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 167	Officers Quarters Military	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 168	General Purp Warehouse	NA	-	105	-	-	-	$0	$0	$0	$0	-
T 172	Cold Storage Warehouse	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 177	Technical Library	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 178	Child Development Cntr	105	110	105	-	3.55	-	$0	$28	$0	$396	$69.57
S 182	Commissary	105	110	105	-	-	0.32	$0	$0	$20	$231	$69.57
S 186	Sup Svc Admin Bldg	0	-	105	-	-	-	$0	$0	$0	$0	-
P 190	Post Chapel	105	125	105	-	-	0.67	$0	$0	$42	$488	$69.57
S 197	Admin Bldg R&D - Office	105	125	105	-	-	0.16	$0	$0	$10	$114	$69.57
	Admin Bldg R&D - Electronics	NA		105	-	-	-	$0	$0	$0	$0	-
S 198	General Inst Bldg	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 205	Admin General Purpose	105	140	105	10.49	-	-	$52	$0	$0	$720	$69.57
P 205A	Company HQ Building	105	135	105	-	-	0.24	$0	$0	$15	$177	$69.57
P 206	Enlisted Pers Dining Fac	140	140	140	0.00	-	-	$0	$0	$0	$0	$69.57
	Kitchen Area - Scullery	140	180	140	-	-	-	$0	$0	$0	$0	-
P 207	Enl Barracks w/o Dining	105	145	105	203.31	-	-	$1,012	$0	$0	$13,952	$69.57
P 207A	Company HQ Building	105	130	105	-	-	0.20	$0	$0	$13	$147	$69.57
P 208	Enl Barracks w/o Dining	105	140	105	198.10	-	-	$987	$0	$0	$13,594	$69.57
P 208A	Company HQ Building	105	140	105	-	-	0.28	$0	$0	$18	$206	$69.57

ECO C-1 Sheet 5 of 7

Fac No.	Installation Name	DHW Temperatures ECO C Temp	Actual Temp	Authorized Temp	ECO C1 Energy Savings Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Investment
P 209	AAFES Snack Bar	105	145	105	-	-	29.67	$0	$0	$1,846	$21,600	$69.57
P 210	Hlth/Dntl Clinic w/ Beds	140	140	140	0.00	-	-	$0	$0	$0	$0	$69.57
P 211	Outdoor Swimming Pool	NA	NA	105	-	-	-	$0	$0	$0	$0	-
P 212	Gymnasium	105	130	105	-	4.63	-	$0	$36	$0	$516	$69.57
P 219	Physical Fitness Center	105	120	105	-	12.26	-	$0	$96	$0	$1,366	$69.57
P 229	Enl Barracks w/o Dining	105	130	105	44.14	-	-	$220	$0	$0	$3,029	$69.57
P 229A	Company HQ Building	105	120	105	-	-	0.12	$0	$0	$8	$88	$69.57
P 230	Enl Barracks w/o Dining	105	129	105	122.38	-	-	$609	$0	$0	$8,399	$69.57
P 230A	Company HQ Building	105	130	105	-	-	0.20	$0	$0	$13	$147	$69.57
S 235	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 236	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 237	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 238	Sig Photo Lab	105	122	105	-	2.93	-	$0	$23	$0	$327	$69.57
	Process	NA	160	-	-	21.55	-	$0	$170	$0	$2,401	$69.57
P 240	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 241	GM Facility	105	120	105	-	-	0.29	$0	$0	$18	$208	$69.57
		NA		-	-	-	-	$0	$0	$0	$0	-
		NA		-	-	-	-	$0	$0	$0	$0	-
S 243	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 244	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 246	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 247	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 252	Vehicle Maint Shop DS	105	120	105	-	-	0.66	$0	$0	$41	$481	$69.57
P 256	Vehicle Maint Shop ORG	105	135	105	-	-	0.39	$0	$0	$25	$287	$69.57
P 259	Vehicle Maint Shop ORG	105	125	105	-	-	0.88	$0	$0	$55	$642	$69.57
S 283	FE Maintenance Shop	NA	-	105	-	-	-	$0	$0	$0	$0	-
		NA		-	-	-	-	$0	$0	$0	$0	-
S 286	Admin General Purpose	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 287	Recreation Building	105	140	105	-	19.57	-	$0	$154	$0	$2,181	$69.57
S 288	General Purpose Warehouse	NA	-	105	-	-	-	$0	$0	$0	$0	-
S 290	Electron Equip Facility	105	135	105	-	9.15	-	$0	$72	$0	$1,020	$69.57
		NA		-	-	-	-	$0	$0	$0	$0	-
S 291	Cont Humid Warehouse	NA	-	105	-	-	-	$0	$0	$0	$0	-
P 295	Enl Barracks w/o Dining	105	128	105	-	199.34	-	$0	$1,569	$0	$22,215	$69.57
P 301	ADP Building	105	132	105	-	-	0.62	$0	$0	$38	$450	$69.57
		NA		-	-	-	-	$0	$0	$0	$0	-
		NA		-	-	-	-	$0	$0	$0	$0	-

ECO C-1 Sheet 6 of 7

Fac No.	Installation Name	DHW Temperatures			ECO C1 Energy Savings							
		ECO C Temp	Actual Temp	Authorized Temp	Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Investment
P 642	Detached Latrine/Shower	105	130	105	-	28.66	-	$0	$226	$0	$3,194	$69.57
S 2201	Control Tower - Range SPT	NA	-	105	-	-	-	$0	$0	$0	$0	-
Totals					578	430	58	$2,881	$3,388	$3,632	$130,157	$5,009
								UPW x Invest =		$55,700	SIR =	~~[illegible]~~ 13.3

ERR

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO C-1
Sheet 7 fo 7

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: Reduce DHW Temperatures
Fiscal Year FY96
Discrete Portion Name: ECO# C-1
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$5,009		
B. SIOH	$275		
C. Design Cost	$301		
D. Total Cost (1A+1B+1C)	$5,585		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$5,585

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost \$/MTBU/(1)	Saving MBTU/YR(2)	Annual \$ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	199.2	$3,632	11.70	$42,496
B. Dist	$4.98	578	$2,881	13.78	$39,694
C. Propane	$7.87	430	$3,388	14.16	$47,968
D. Demand	$108.60	0.0 k	$0	11.70	$0
E. Other					
F. Total			$9,900		$130,157

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($5,009)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($55,700)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) ($55,700)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 1.1 Years
5. Total Net Discounted Savings (2F5+3C): $74,457
6. Savings to Investment Ratio (SIR) 5/1G: 13.33
7. Adjusted Internal Rate of Return (AIRR): 87.56%

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO # C2
INSULATE DOMESTIC HOT WATER PIPES

PROJECT FHL EEAP
16-403-10
SHEET NO. ___ OF ___ SHEETS

DESCRIPTION OF WORK

REDUCE ENERGY CONSUMPTION BY THE INSTALLATION OF INSULATION ON DOMESTIC HOT WATER PIPES.

EVALUATION SUMMARY / APPROACH

DOMESTIC HOT WATER SYSTEMS FOR THE PURPOSES OF ANALYSIS CAN BE DIVIDED INTO TWO TYPES

1.) NON-CIRCULATED
2.) CIRCULATED.

1. NON CIRCULATED SYSTEMS
TYPICAL OF MOST RESIDENCE - LIVING TYPE OCCUPANCIES. HOT WATER FROM THE WATER HEATER / TANK SITS, MOTIONLESS, IN THE PIPES UNTIL A FAUCET OR VALUE IS OPENED. STANDING HOT WATER LOSSES HEAT TO THE AMBIENT AIR AS CHARACTERIZED BY THE FOLLOWING EQUATION:

$$T(\theta) = T_o + (T_i - T_o)e^{-\frac{\theta}{C_T/U_T}}$$

T = TEMPERATURE AT TIME INCREMENT θ

T_o = AMBIENT TEMPERATURE, ASSUMED TO BE 55°F

T_i = INITIAL TEMPERATURE, TAKEN TO BE THE DHW HEATER SET POINT TEMPERATURE

θ = ELAPSED TIME

C_T = HEAT CAPACITY OF WATER 1 BTU/°F

U_T = CONDUCTANCE OF PIPE AND INSULATION IF ANY BTU/HR·°F

FORM 101-1/8

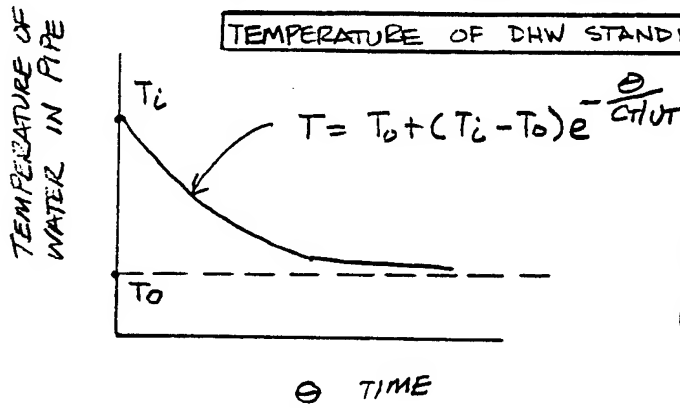
COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY JCS	ECO #C2	PROJECT FHL EEAP 16-403-01
CHECKED BY	INSULATE DOMESTIC HOT WATER PIPES	
DATE 19		
REV. 19		SHEET NO. OF SHEETS

1. NON-CIRCULATED SYSTEMS CONTINUED.

TEMPERATURE OF DHW STANDING IN PIPES



U_T

BARE PIPE	1" THICK INSULATION
8.4 $\frac{Btu}{hr\cdot °F}$	1.5 $\frac{Btu}{hr\cdot °F}$

TWO QUESTIONS ARISE: 1. HOW LONG DOES IT TAKE THE WATER IN THE PIPE TO COOL TO AN UNACCEPTABLE LEVEL?

2.) DOES ADDING INSULATION AFFECT THIS TIME SIGNIFICANTLY?

BARE PIPE – $T_{AMBIENT} = 55°F$

HOW LONG DOES IT TAKE 140°F WATER TO COOL TO BELOW 90°F

$$90 = 55 + (140-55)e^{-\frac{\theta}{C/U_T}}$$

$$\ln(35) = \frac{\theta \cdot U_T}{C_T} \cdot \ln(85)$$

$$\theta = -\ln\left(\frac{35}{85}\right) \times \frac{1}{8.4} = 0.11 \text{ hrs} = 6.6 \text{ minutes}$$

INSULATED PIPE

$$\theta = -\ln\left(\frac{35}{85}\right) \times \frac{1}{1.5} = 0.59 \text{ hrs} = 35 \text{ minutes}$$

THUS, IF THE WATER DEMAND IS NO MORE FREQUENT THAN EVERY 1/2 HOUR, THEN INSULATION MAKES NO DIFFERENCE.

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS CHECKED BY DATE FEBRUARY 1993 REV. 19__	ECO # C2 INSULATE DOMESTIC HOT WATER PIPES	PROJECT FHL EEAP 16-403-10 SHEET NO. ____ OF ____ SHEETS

2. CIRCULATED HOT WATER SYSTEMS

HOT WATER CONTINUOUSLY CIRCULATES THROUGH THE PIPING SYSTEM. THE WATER TEMPERATURE IS MAINTAINED AT OR NEAR THE WATER HEATER SET POINT TEMPERATURE HEAT TRANSFER IS STEADY-STATE UNLIKE NON-CIRCULATED SYSTEMS.

SAMPLE CALCULATIONS FOR CIRCULATED SYSTEM HEAT LOSSES FOLLOW THIS NARRATIVE.

THE FIELD INVESTIGATION YIELDED THE OBSERVATION THAT MOST PIPES HAD INSULATION AND ONLY SOME REQUIRED REPAIR.

A SUMMARY OF ENERGY SAVINGS FOR BUILDINGS THAT REQUIRED INSULATION REPAIR FOLLOWS THIS NARRATIVE.

ORDER OF IMPLEMENTATION

THIS WAS THE 2ND ECO ASSUMED TO BE IMPLEMENTED.

ECO-C2 INSTALL PIPE INSULATION IN CIRCULATED HOT WATER SYSTEMS

Analysis of Circulated Domestic Hot Water Energy Savings

Fac No.	Baseline			ECO #2 Energy Savings							
	DHW Temp	Pipe Loss Mil BTU/Yr	Pipe Loss Mil BTU/Yr	Fuel Oil Mil BTU/Y	Propane Mil BTU/Y	Electric Mil BTU/Y	FO Ann. $ Savings	Prop. Ann. $ Savings	Elect. Ann $ Savings	LCC Savings	Investment
T 120	105	10.8	10.8	-	0	-	$0	$0	$0	$0	$0
	140	16.8	16.8	-	0	-	$0	$0	$0	$0	$0
205	140	42.4	42.4	0	-	-	$0	$0	$0	$0	$0
206	140	74.0	74.0	0	-	-	$0	$0	$0	$0	$0
207	105	55.5	42.4	13.1	-	-	$65	$0	$0	$899	$100
208	105	55.5	53.0	2.5	-	-	$12	$0	$0	$172	$100
229	105	46.5	35.5	11.0	-	-	$55	$0	$0	$755	$100
230	105	45.9	34.9	11.0	-	-	$55	$0	$0	$755	$100
S 238	105	19.3	0.0	-	7.0	-	$0	$55	$0	$780	$60
S 290	105	14.2	0.0	-	7.9	-	$0	$62	$0	$880	$60
			Totals	37.6	14.9	-	$187	$117	$0	$4,241	$520

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet Of
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-C2 Install Pipe Insulation	Estimator	Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg. 207, F/g insul. for 2" pipe	10	LF	$6	$60	$4	$40	$100
Bldg. 208, F/g inusl. for 2" pipe	10	LF	$6	$60	$4	$40	$100
Bldg. 229, F/g insul. for 2" pipe	10	LF	$6	$60	$4	$40	$100
Bldg. 230, F/g insul. for 2" pipe	10	LF	$6	$60	$4	$40	$100
Bldg. 238, F/g insul. for 1" pipe	10	LF	$4	$40	$2	$20	$60
Bldg. 290, F/g insul. for 1" pipe	10	LF	$4	$40	$2	$20	$60
Subtotal							$520
Sales Tax @ 8%							$42
Subtotal							$562
Contractor OH & Profit @ 30%							$168
Subtotal							$730
Bond @ 1%							$7
Subtotal							$737
Estimating Contingency @ 10%							$74
Total Probable Construction Cost							$811

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California Region No. 4 Project No. 16-403-10
Project Title: ECO-C2 INSTALL PIPE INSULATION Fiscal Year FY96
Discrete Portion Name: Bldgs. 127, 197, 212, 240 & 301
Analysis Date: March 1993 Economic Life: 15 YEARS Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$811		
B. SIOH	$45		
C. Design Cost	$0		
D. Total Cost (1A+1B+1C)	$856		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$856

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	0	$0	11.70	$0
B. Dist	$4.98	48	$240	13.78	$3,308
C. Propane	$7.87	15	$117	14.16	$1,660
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		63	$357		$4,968

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	2.4 Years
5. Total Net Discounted Savings (2F5+3C):	$4,968
6. Savings to Investment Ratio (SIR) 5/1G:	5.81
7. Adjusted Internal Rate of Return (AIRR):	41%

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY JCS CHECKED BY DATE FEBRUARY 1993 REV. 19__	ECO # C3 INSULATE HOT WATER STORAGE TANKS	PROJECT FHL EEAP 16-403-10 SHEET NO. ___ OF ___ SHEETS

DESCRIPTION OF WORK

REDUCE ENERGY CONSUMPTION BY INSULATING HOT WATER STORAGE TANKS.

EVALUATION SUMMARY / APPROACH

HEAT LOSSES FROM HOT WATER TANKS WERE ESTIMATED USING GUIDANCE FROM "ARCHITECTS & ENGINEERS GUIDE TO ENERGY CONSERVATION IN EXISTING BUILDINGS," PUBLISHED BY THE US DEPT. OF ENERGY. THE GUIDE WAS USED TO ESTIMATE BASELINE AND REDUCED HEAT LOSSES. THE TWO WERE COMPARED TO DETERMINE ENERGY SAVINGS.

ORDER OF IMPLEMENTATION

THIS OPPORTUNITY WAS ASSUMED TO BE THE SECOND TO BE IMPLEMENTED

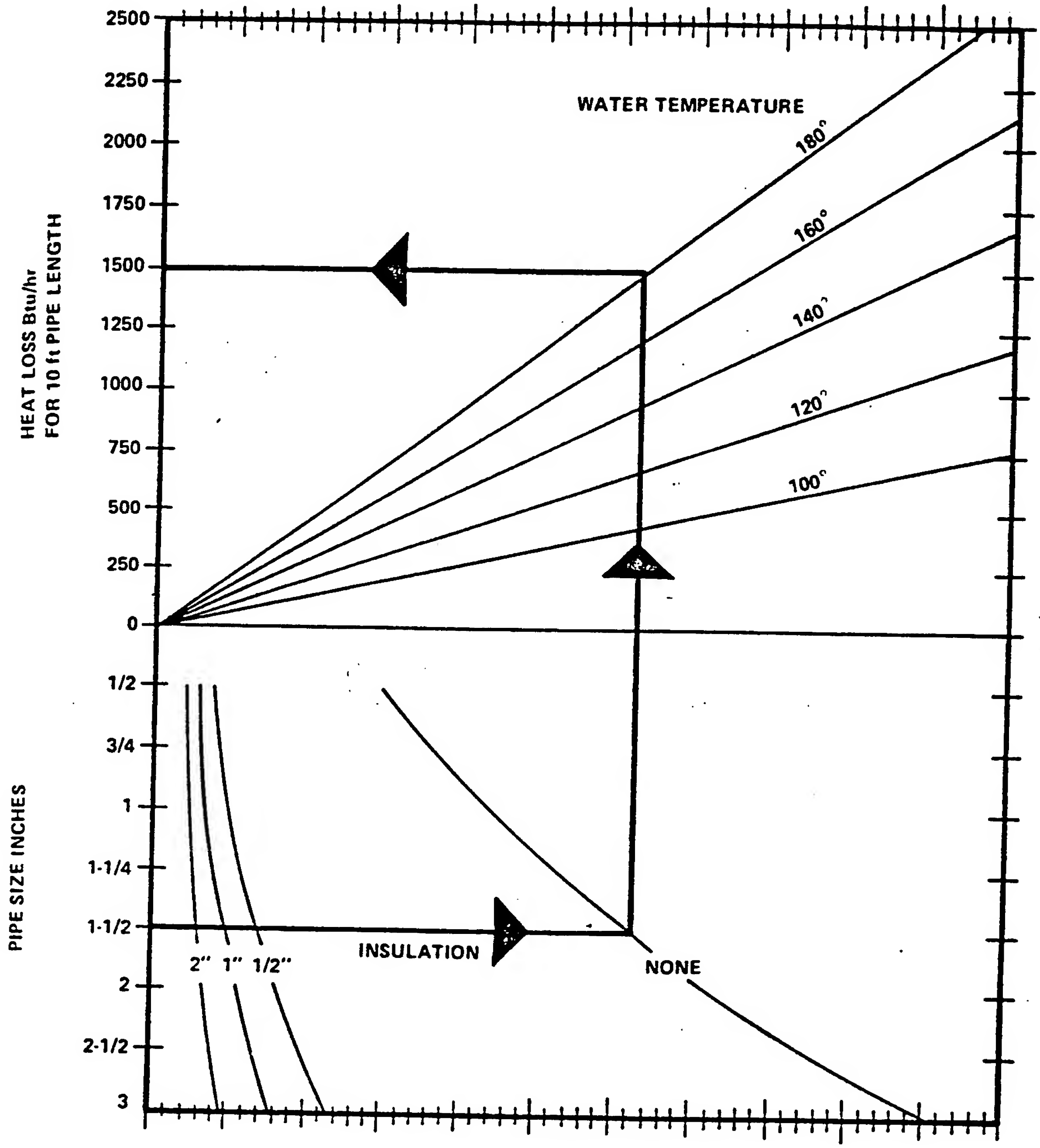


FIGURE 8-47. HEATING-HEAT LOSS FOR VARIOUS PIPE SIZES, INSULATION THICKNESS, AND WATER TEMPERATURES FROM 100°F TO 180°F

DOMESTIC HOT WATER TANK INSULATION LOSSES:

Insulation Thickness (k = 0.3)	Tank Gallons	BTUH Losses at Water Temperatures							
		100 Deg F	120 Deg F	122 Deg F	128 Deg F	135 Deg F	140 Deg F	160 Deg F	180 Deg F
	6	519	863	897	1,001	1,121	1,207	1,634	2,060
	20	768	1,277	1,327	1,480	1,658	1,785	2,407	3,028
	40	1,123	1,867	1,941	2,165	2,425	2,611	3,510	4,409
	50	1,301	2,163	2,249	2,507	2,809	3,024	4,062	5,100
	52	1,337	2,222	2,311	2,576	2,886	3,107	4,173	5,238
	69	1,639	2,724	2,833	3,158	3,538	3,809	5,111	6,413
Bare	80	1,834	3,049	3,170	3,534	3,959	4,263	5,718	7,172
	83	1,888	3,138	3,262	3,637	4,075	4,387	5,884	7,380
	100	2,190	3,640	3,784	4,219	4,727	5,089	6,822	8,554
	125	2,465	4,097	4,260	4,749	5,320	5,728	7,682	9,637
	250	3,840	6,382	6,636	7,398	8,288	8,923	11,967	15,051
	500	6,292	10,456	10,872	12,122	13,579	14,620	19,640	24,660
	850	9,725	16,160	16,804	18,735	20,987	22,596	30,354	38,113
	1,700	18,062	30,014	31,209	34,794	38,978	41,966	56,374	70,783
	6	83	129	134	147	164	175	223	270
	20	122	191	198	219	243	260	330	400
	40	178	280	290	320	356	381	483	585
	42	184	289	299	330	367	393	499	604
	50	206	324	335	371	412	441	560	678
	52	212	333	345	381	423	453	575	697
	69	259	408	422	467	519	556	705	854
1-inch Thick	80	290	456	473	522	581	622	789	956
	82	296	465	482	533	592	634	805	975
	100	346	545	564	624	693	743	943	1,142
	125	390	613	635	702	780	836	1,061	1,285
	250	607	955	990	1,094	1,216	1,303	1,653	2,002
	500	994	1,565	1,622	1,793	1,992	2,135	2,708	3,280
	850	1,536	2,418	2,506	2,771	3,079	3,300	4,185	5,069
	1,700	2,852	4,490	4,654	5,146	5,719	6,129	7,772	9,414
	50	109	173	179	198	220	236	299	362
2-inch Thick	100	184	291	301	333	370	397	503	609
	250	323	510	528	584	649	696	883	1,069
	500	528	834	865	956	1,064	1,140	1,446	1,751
	6	29	46	48	53	59	63	81	98
	15	40	63	65	73	81	86	110	133
	20	43	69	71	79	88	94	120	145
	40	64	101	105	116	129	138	175	212
	42	66	104	108	119	133	142	180	218
	50	74	117	121	134	149	160	203	245
	52	76	120	124	138	153	164	208	252
	69	93	148	153	169	188	202	255	308
3-inch Thick	80	105	166	172	190	211	226	286	345
	83	108	171	177	196	217	233	294	355
	100	125	198	205	227	252	270	341	412
	125	141	222	230	255	283	304	384	464
	250	219	346	359	397	441	473	598	722
	500	359	567	588	650	723	775	980	1,184
	850	555	876	909	1,005	1,117	1,198	1,514	1,831
	1,075	681	1,075	1,115	1,233	1,370	1,470	1,857	2,247

Source: Architects and Engineers Guide to Energy Conservation in Existing Buildings, February 1980, U.S. DOE.

ECO # C3

Assumptions:

1. Existing Hot Water Heater tanks that do not have insulatiuon blankets are assumed to have the equivalent of 1-inch thick insulation.

2. Installation of an insulation jacket will provide the equivalent of 3-inch thick insulation.

3. Heat losses are in addition to those included in "Efficiency" calulation under "Convection Losses".

4. Unless controlled by time clock or othet means, losses are assumed to be continuous, 8,760 Hours per year.

DOMESTIC HOT WATER TANK INSULATION

Building Number	Tank Gallons	Existing Temp Deg F	Existing Condtion Tank Insltn Inches	Existing Condtion Heat Loss Mil BTU/Yr	Proposed Condtion Tank Insltn Inches	Proposed Condtion Heat Loss Mil BTU/Yr	Heat Loss Load Saved Mil BTU/Yr
6	40	135	1	3.1	3	2.5	0.6
80	80	135	1	5.1	3	1.8	3.3
81	20 & 40	135	1	5.2	3	1.9	3.3
101	100	160	1	8.3	3	3.0	5.3
101.1	40	140	1	3.3	3	1.2	2.1
101.2	83	140	1	5.6	3	2.0	3.6
120	100	110	1	3.9	3	1.4	2.5
120.1	100	140	1	6.5	3	2.4	4.1
124	40	160	1	4.2	3	1.5	2.7
127	100	128	1	5.5	3	2.0	3.5
131	40	135	1	3.1	3	1.1	2.0
144	69	Not used	1	0.0	3	0.0	0.0
149	40	135	1	3.1	3	1.1	2.0
197	6	128	1	1.3	3	0.5	0.8
206	2 x 850	140	1	57.8	3	21.0	36.8
210	100	140	1	6.5	3	2.4	4.1
219	80	120	1	4.0	3	1.5	2.5
238	125	122	1	5.6	3	2.0	3.6
252	52	120	1	2.9	3	1.1	1.8
287	40	140	1	3.3	3	1.2	2.1
290	100	135	1	6.1	3	2.2	3.9

Assumptions:

1. Existing Hot Water Heater tanks that do not have insulatiuon blankets are assumed to have the equivalent of 1-inch thick insulation.

2. Installation of an insulation jacket will provide the equivalent of 3-inch thick insulation.

3. Heat losses are in addition to those included in "Efficiency" calulation under "Convection Losses".

4. Unless controlled by time clock or othet means, losses are assumed to be continuous, 8,760 Hours per year.

DOMESTIC HOT WATER TANK INSULATION

Building Number	Tank Gallons	Existing Temp Deg F	Existing Condtion Tank Insltn Inches	Existing Condtion Heat Loss Mil BTU/Yr	Proposed Condtion Tank Insltn Inches	Proposed Condtion Heat Loss Mil BTU/Yr	Heat Loss Load Saved Mil BTU/Yr
6	40	135	1	3.1	3	2.5	0.6
80	80	135	1	5.1	3	1.8	3.3
81	20 & 40	135	1	5.2	3	1.9	3.3
101	100	160	1	8.3	3	3.0	5.3
101.1	40	140	1	3.3	3	1.2	2.1
101.2	83	140	1	5.6	3	2.0	3.6
120	100	110	1	3.9	3	1.4	2.5
120.1	100	140	1	6.5	3	2.4	4.1
124	40	160	1	4.2	3	1.5	2.7
127	100	128	1	5.5	3	2.0	3.5
131	40	135	1	3.1	3	1.1	2.0
144	69	Not used	1	0.0	3	0.0	0.0
149	40	135	1	3.1	3	1.1	2.0
197	6	128	1	1.3	3	0.5	0.8
206	2 x 850	140	1	57.8	3	21.0	36.8
210	100	140	1	6.5	3	2.4	4.1
219	80	120	1	4.0	3	1.5	2.5
238	125	122	1	5.6	3	2.0	3.6
252	52	120	1	2.9	3	1.1	1.8
287	40	140	1	3.3	3	1.2	2.1
290	100	135	1	6.1	3	2.2	3.9

ECO-C3 INSULATE HOT WATER HEATERS

Fac No.	Existing Condition Tank Insltn Inches	Existing Condition Heat Loss Mil BTU/Yr	ECO - C3 Energy Savings Tank Insltn Inches	Fuel Oil Mil BTU/Yr	Propane Mil BTU/Y	Electric Mil BTU/Y	FO Ann. $ Savings	Prop. Ann $ Savings	Elec. Ann $ Savings	LCC Savings	Investment
T 6	1	3.1	3	-	3.6	-	$0	$28	$0	$398	$75
P 80	1	5.1	3	-	-	1.8	$0	$0	$33	$384	$75
P 81	1	5.2	3	-	-	1.9	$0	$0	$35	$405	$75
P 101	1	8.3	3	-	4.3	-	$0	$34	$0	$478	$100
	1	3.3	3	-	1.7	-	$0	$13	$0	$191	$75
	1	5.6	3	-	2.9	-	$0	$22	$0	$318	$75
T 120	1	3.9	3	-	1.9	-	$0	$15	$0	$207	$100
	1	6.5	3	-	3.4	-	$0	$27	$0	$382	$100
T 124	1	4.2	3	-	2.1	-	$0	$17	$0	$239	$75
T 127	1	5.5	3	-	2.9	-	$0	$22	$0	$318	$100
T 131	1	3.1	3	-	1.6	-	$0	$12	$0	$175	$75
S 144	1	0	-	-	-	-	$0	$0	$0	$0	$0
T 149	1	3.1	3	-	1.6		$0	$12	$0	$175	$75
S 197	1	1.3	3	-	-	0.5	$0	$0	$9	$107	$75
P 206	1	57.8	3	24.2	-	-	$120	$0	$0	$1,660	$1,560
P 210	1	6.5	3	3.4	-	-	$17	$0	$0	$235	$100
P 219	1	4.0	3	-	2.0		$0	$16	$0	$220	$75
S 238	1	5.6	3	-	2.5	-	$0	$20	$0	$278	$100
P 252	1	2.9	3	-	-	1.1	$0	$0	$20	$235	$75
P 287	1	3.3	3	-	1.6	-	$0	$13	$0	$183	$75
S 290	1	6.1	3	-	3.1	-	$0	$25	$0	$348	$100
			Totals	27.6	35.1	5.3	$138	$276	$97	$6,936	$3,160

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet Of
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-C3 Insulate DHW Heaters	Estimator	Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
< 80 Gal. DHW Heater insulation kit	2	EA	$24	$48	$13	$25	$75
fiberglass 1 1/2" Thick							
Typical for 13 others	11	-	-	-	-	-	$825
> 80 Gal. DHW Heater	7	EA	$65	$455	$35	$245	$700
850 Gal. Tank Insulated w/ 3" CaSil	2	EA	$455	$910	$325	$650	$1,560
Subtotal							$3,160
Sales Tax @ 8%							$253
Subtotal							$3,413
Contractor OH & Profit @ 30%							$1,024
Subtotal							$4,437
Bond @ 1%							$44
Subtotal							$4,481
Estimating Contingency @ 10%							$448
Total Probable Construction Cost							$4,929

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: ECO-C3 INSTALL TANK INSULATION   Fiscal Year FY96
Discrete Portion Name:
Analysis Date: March 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$3,160		
B. SIOH	$174		
C. Design Cost	$0		
D. Total Cost (1A+1B+1C)	$3,334		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$3,334

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	5	$97	11.70	$1,130
B. Dist	$4.98	28	$137	13.78	$1,894
C. Propane	$7.87	35	$275	14.16	$3,900
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		68	$510		$6,925

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	6.5	Years
5. Total Net Discounted Savings (2F5+3C):	$6,925	
6. Savings to Investment Ratio (SIR) 5/1G:	2.08	
7. Adjusted Internal Rate of Return (AIRR):	13%	

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY JCS CHECKED BY DATE FEBRUARY 1993 REV. 19	ECO # C4 ELECTRIC IGNITORS FOR GAS HOT WATER HEATERS	PROJECT FHL EEAP 16-403-10 SHEET NO. OF SHEETS

DESCRIPTION OF WORK

REDUCE GAS CONSUMPTION BY ELIMINATING CONTINUOUSLY BURNING GAS PILOT LIGHT IN DOMESTIC HOT WATER HEATERS. INSTALL ELECTRIC PILOT INGNITORS TO FIRE WATER HEATERS.

EVALUATION SUMMARY / APPROACH

EVEN WELL INSULATED HOT WATER HEATERS HAVE HEAT LOSSES. CONTINUOUSLY BURNING GAS PILOT LIGHTS SERVE TO OFFSET TANK LOSSES, PREVENTING THE HEATER FROM CYCLING ON & OFF TO MAINTAIN THE WATER TEMPERATURE. ELECTRIC PILOT LIGHTS PROVIDE NO HEAT TO OFFSET TANK HEAT LOSSES, CAUSING THE HEATER TO CYCLE ON AND OFF TO MAINTAIN THE SET POINT WATER TEMPERATURE. THE REDUCTION IN HEATER LIFE AS RESULT OF THIS CYCLING WOULD GREATLY OFFSET OR ELIMINATE ANY COST SAVINGS DUE TO REDUCED GAS CONSUMPTION.

THIS OPPORTUNITY SHOULD NOT BE IMPLEMENTED

ORDER OF IMPLEMENTATION

THIS OPPORTUNITY WAS ASSUMED NOT TO BE IMPLEMENTED.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY JCS CHECKED BY DATE FEBRUARY 1993 REV. 19	ECO # C5 REDUCE DOMESTIC HOT WATER USE AT THE FAUCET	PROJECT FHL EEAP 16-403-10 SHEET NO. ___ OF ___ SHEETS

DESCRIPTION OF WORK

REDUCE HOT WATER USAGE BY THE INSTALLATION OF METERING OR SENSOR OPERATED LAVATORY FAUCETS AND/OR LOW FLOW FAUCETS AND SHOWER HEADS.

EVALUATION SUMMARY / APPROACH

HOT WATER CONSUMPTION CAN BE REDUCED BECAUSE FAUCETS CANNOT BE LEFT OPEN, RUNNING CONTINUOUSLY.

METERING FAUCETS ALLOW WATER FLOW FOR LIMITED PERIODS THEN THE VALVE CLOSES UNTIL THE LEVER IS DEPRESSED AGAIN.

SENSOR OPERATED LAVATORY FAUCETS ONLY PERMIT WATER FLOW IF A SENSOR PERCEIVES A PERSON'S HANDS INSIDE THE LAVATORY BOWL.

ALTHOUGH CATALOG LITERATURE CLAIMS INSTALLATION OF SAID VALVES WOULD REDUCE WATER CONSUMPTION BY 80%, IT WAS MORE CONSERVATIVELY ASSUMED TO RESULT IN A 50% REDUCTION IN WATER CONSUMPTION.

THUS THE WATER SAVINGS WAS FOUND BY:

$$= (\#\text{ OF PEOPLE}) \times \left(\frac{4\text{ HAND WASHES}}{\text{DAY}}\right) \times \left(\frac{1\text{ MINUTE}}{\text{HAND WASH}}\right) \times \left(3.0\,\frac{\text{GAL}}{\text{MIN}}\right) \times 50\%$$

$$= (\#\text{ OF PEOPLE}) \times \frac{6\text{ GAL}}{\text{CAP - DAY}}$$

DHW USAGE CAN ALSO BE REDUCED BY THE INSTALLATION OF FLOW RESTRICTING SHOWER HEADS AND LAVATORY FAUCET INSERTS

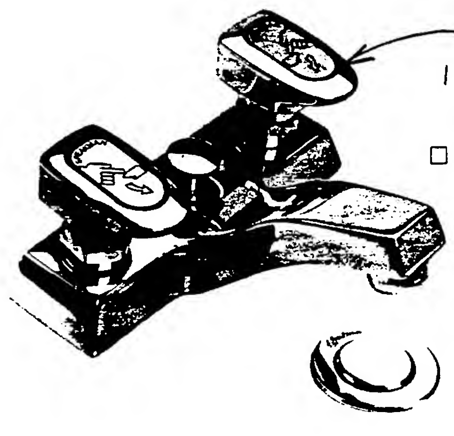
ORDER OF IMPLEMENTATION

THE INSTALLATION OF FLOW RESTRICTORS WAS ASSUMED TO BE THE THIRD OPPORTUNITY IMPLEMENTED.

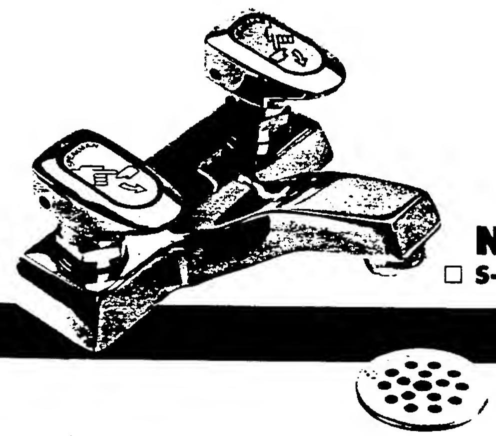
FORM 101-1/8

SPEAKMAN EASY-PUSH®

$190.00
15min to install



NEW
☐ S-4131

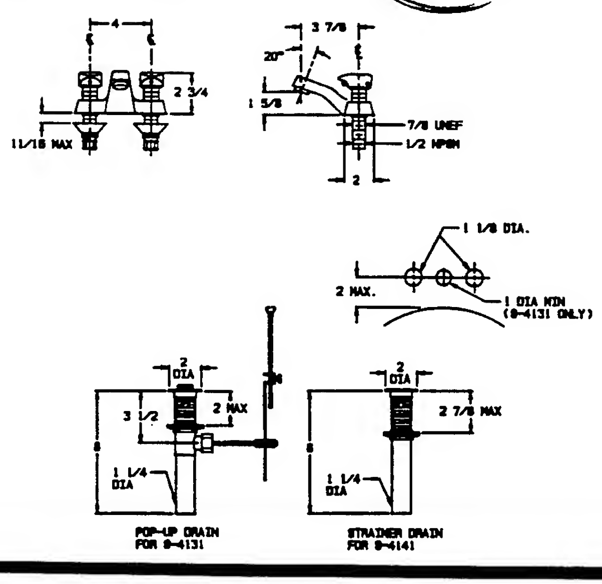


NEW
☐ S-4141

Metering Lavatory Centerset Combinations

☐ **S-4131**
Speakman Polished Chrome Plated EASY-PUSH 4" Centerset Metering Lavatory Combination. Color-coded EASY-PUSH handles with brass yokes. Concealed cycle adjustment without shutting off water supply. 1¼" P.O. pop-up drain. Nonhammering operating units protected by monel mesh screens. Vandal-resistant standard. Water conserving, vandal-resistant flow control device reduces flow to a maximum of 3.0 gpm at 80 pounds flow pressure.

☐ **S-4141**
Speakman Polished Chrome Plated EASY-PUSH 4" Centerset Metering Lavatory Combination. Color-coded EASY-PUSH handles with brass yokes. Concealed cycle adjustment without shutting off water supply. 1¼" P.O. strainer drain. Nonhammering operating units protected by monel mesh screens. Vandal-resistant standard. Water conserving, vandal-resistant flow control device reduces flow to a maximum of 3.0 gpm at 80 pounds flow pressure.



OPTIONS

SUFFIX	DESCRIPTION
☐ BOCA/FLO	Vandal-Resistant 0.5 gpm Flow Regulator
☐ BH	Brass Handles
☐ LD	Less Drain Assembly
☐ PALM	Palm Buttons (not handicapped approved)

BH PALM

NOTE: Inlets are sized for either coupling or sweat connections. All dimensions are in inches and are subject to change without notice.

This space for Architect/Engineer approval.

EASY-PUSH® - Registered T.M. Speakman Company

SPEAKMAN
The Quality Leader Since 1869
P.O. Box 191, Wilmington, DE 19899-0191
1-302/764-9100, FAX: 1-302/764-1956

3.0 gpm flow control device meets ANSI A112.18.1, 1989 Standard.

C5

ECO-~~9~~ DOMESTIC HOT WATER SYSTEM SUMMARY

FLOW RESTRICTING SHOWER HEAD AND LAVATORY FAUCET RETROFIT

	Non Lo-Flow Devices:	Lo-Flow Devices:
Shower Heads	5.00 gpm	2.00 gpm
Faucets	3.00 gpm	0.75 gpm

Function Code 1: Offices 2.00 GPCD

Assume use from faucets 75% and by Janitor 25%.
Usage with Lo-Flow faucet aspirators: 1.10 GPCD

Function Code 2: Shops & Warehouses 5.00 GPCD

Assume use from faucets 50% of total usage.
Usage with Lo-Flow faucet aspirators: 3.50 GPCD

Function Code 2.1: Commercial Laundries - Not Applicable to this ECO.

Function Code 3: Barracks & Quarters w/o Dining 30.00 GPCD

Usage	GPCD	Lo-Flow GPCD
Showers	19.50	7.80
Faucets	4.50	1.13
Clothes Washing	6.00	6.00
Total	30.00	14.93

Function Code 3.1: Detatched Latrine with Bathing 25.00 GPCD

Usage	GPCD	Lo-Flow GPCD
Showers	19.50	7.80
Faucets	4.50	1.13
Clothes Washing	0.00	0.00
Total	24.00	8.93

Function Code 4: Barracks & Quarters with Dining 30.00 GPCD

Same as Function Code 3 for non-cooking hot water usage:

14.93 GPCD

Function Code 5: Recreation & Gyms w/o Bathing 0.50 GPCD

Assume use from faucets 50% of total usage.
Usage with Lo-Flow faucet aspirators: 0.35 GPCD

c5

ECO-~~91~~ DOMESTIC HOT WATER SYSTEM SUMMARY

Function Code 5.1: Recreation & Gyms with Bathing 12.00 GPCD

Usage	GPCD	Lo-Flow GPCD
Showers	10.50	4.20
Faucets	1.50	0.38
Clothes Washing	0.00	0.00
Total	12.00	4.58

ECO - C5 Installation of Self-Metering Faucets

Fac No.	Domestic Hot Water Heating System			ECO C5 Energy Savings					
	Fuel Used	System Temp.	Capacity BTUH	Fuel Oil Mil BTU/Yr	Propane Mil BTU/Y	Electric Mil BTU/Y	Elect. Ann $ Savings	LCC Savings	Investment
182	Electric	110	240,000	-	-	0.7	$13	$181	$720
197	Electric	125	240,000	-	-	3.6	$66	$929	$720
212	Electric	130	1,875,000	-	-	8.8	$160	$2,272	$1,440
240	None	0	1,875,000	-	-	-	-	-	-
301	Electric	132	1,875,000	-	-	20.1	$366	$5,189	$720
				-	-	33.2	$239	$3,382	$3,600

CONSTRUCTION COST ESTIMATE

Date Prepared	February 1993
Sheet Of	
Project	EEAP Limited Energy Study
Project No.	
Basis for Estimate	Code A (no design competed)
Location	Fort Hunter-Liggett, California
Engineer-Architect	Keller & Gannon
Drawing No.	ECO-C5 Install Flow Metering Faucets
Estimator	
Checked By	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Self-Metering Lav. Faucets	15	EA	$40	$600	$200	$3,000	$3,600
Subtotal							$3,600
Sales Tax @ 8%							$288
Subtotal							$3,888
Contractor OH & Profit @ 30%							$1,166
Subtotal							$5,054
Bond @ 1%							$51
Subtotal							$5,105
Estimating Contingency @ 10%							$510
Total Probable Construction Cost							$5,615

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California Region No. 4 Project No. 16-403-10
Project Title: ECO-C5 Self-metering faucets Fiscal Year FY96
Discrete Portion Name: Bldgs. 182, 197, 212, 240 & 301
Analysis Date: March 1993 Economic Life: 15 YEARS Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$5,615		
B. SIOH	$309		
C. Design Cost	$337		
D. Total Cost (1A+1B+1C)	$6,261		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$6,261

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	33	$605	11.70	$7,081
B. Dist	$4.98	0	$0	13.78	$0
C. Propane	$7.87	0	$0	14.16	$0
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		33	$605		$7,081

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 10.3 Years
5. Total Net Discounted Savings (2F5+3C): $7,081
6. Savings to Investment Ratio (SIR) 5/1G: 1.13
7. Adjusted Internal Rate of Return (AIRR): 5.04%

ECO-C5 REDUCTION IN DOMESTIC HOT WATER CONSUMPTION

Analysis of the Effect of Installation of Flow Restricting Faucets/Shower Heads on Domestic Hot Water Energy Savings

Bldg. No.	Domestic Hot Water Heating System		
	Fuel Used	System Temp.	Capacity BTUH
127	Propane	110	240,000
197	Electric	125	1.25 kW

ECO C5 Energy Savings					
Propane Mil BTU/Yr	Electric Mil BTU/Y	Prop. Ann $ Savings	Elect. Ann $ Savings	LCC Savings	Investment
2.1	-	$17	-	$239	$135
-	12.8	-	$233	$2,730	$140
2.1	12.8	$17	$233	$2,969	$275

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet Of
Project: EEAP Limited Energy Study	Project No.	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-C5 Install Flow Restrictors	Estimator	Checked By

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Bldg. 127 Lavatory Flow Restrictors	1	LS	-	$25	-	$45	$70
Bldg. 127 Shower Flow Restrictors	1	LS	-	$25	-	$40	$65
Bldg. 197 Lavatory Flow Restrictors	1	LS	-	$25	-	$30	$55
Bldg. 197 Shower Flow Restrictors	1	LS	-	$25	-	$60	$85
Subtotal							$275
Sales Tax @ 8%							$22
Subtotal							$297
Contractor OH & Profit @ 30%							$89
Subtotal							$386
Bond @ 1%							$4
Subtotal							$390
Estimating Contingency @ 10%							$39
Total Probable Construction Cost							$429

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California   Region No. 4   Project No. 16-403-10
Project Title: ECO-C5 Install Flow Restrictors   Fiscal Year FY96
Discrete Portion Name: Bldgs. 127 & 197
Analysis Date: March 1993   Economic Life: 15 YEARS   Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$475		
B. SIOH	$26		
C. Design Cost	$0		
D. Total Cost (1A+1B+1C)	$501		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$501

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.23	13	$233	11.70	$2,730
B. Dist	$4.98	0	$0	13.78	$0
C. Propane	$7.87	2	$17	14.16	$234
D. Other	NA	0	$0	NA	NA
E. Demand Savings			$0	11.70	$0
F. Total		15	$250		$2,964

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.	$0	15	0.56	$0
b.	$0	15	0.56	$0
c.	$0	15	0.56	$0
d. Total	$0	0	0.00	$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	2.0	Years
5. Total Net Discounted Savings (2F5+3C):	$2,964	
6. Savings to Investment Ratio (SIR) 5/1G:	5.91	
7. Adjusted Internal Rate of Return (AIRR):	49.75%	

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY JCS
CHECKED BY
DATE FEBRUARY 1993
REV. 19

ECO # C6
USE COLD WATER FOR LAUNDERING

PROJECT FHL EEAP
16-403-10

SHEET NO. ____ OF ____ SHEETS

DESCRIPTION OF WORK

REDUCE ENERGY CONSUMPTION BY USING COLD WATER INSTEAD OF HOT AT LAUNDRY MACHINES.

EVALUATION SUMMARY/APPROACH

ON PAPER THIS ECO ALWAYS HAS CONSIDERABLE ENERGY SAVING POTENTIAL WITHOUT MUCH INITIAL COST.

HOWEVER, IT HAS BEEN KELLER AND GANNON'S EXPERIENCE IN SURVEYING HUNDREDS OF MILITARY BUILDINGS THAT THIS ECO IS INVARIABLY DEFEATED BY THE BUILDINGS OCCUPANTS.

ORDER OF IMPLEMENTATION

THIS ECO WAS ASSUMED NOT TO BE IMPLEMENTED

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY B/H	ECO C7	PROJECT 16-403-10
CHECKED BY	REPLACE ELEC. BOOSTER	FHL EEAP
DATE MARCH 1993	HEATER FOR CAN WASHER	
REV. 19		SHEET NO. 1 OF 5 SHEETS

PG&E SURVEY OF 1982 SUGGESTED THE FOLLOWING

The following is copied from PG&E's Energy Audit Report.

18. Garbage can washer booster.

Demand Reduction = 58.5 kw (booster capacity)

Energy Savings = 58.5 kw x 730 hrs/yr
= 42,705 kwh/yr

Cost Savings = 42,705 kwh/yr x $0.0801/kwh
= $3,420.67/yr

Additional use of fuel oil = 42,705 kwh/yr x 3,413 BTU/kwh x $\frac{1}{.75 \text{ boiler eff.}}$ x gal/150,000 BTU

= 1,296 gal/yr

Additional Cost = 1,296 gal/yr x $1.20/gal
= $1,555.20/yr

Net energy loss at site; net energy gain at source of electricity generation.

Net Cost Savings = $1,865.47/yr

Estimated Cost = $3,000 for heat exchanger and piping installed

Simple Payback = $\frac{\$3,000 \text{ cost}}{\$1,865.47/\text{yr savings}}$

= 1 year 8 months

HOT WATER

18. Garbage can washer booster.

Recommend: Consider replacing the electric booster for the garbage can washer at building #206 with one with a heat source from the existing boiler at that building. This action will reduce the cost of cleaning the cans while reducing the electric demand for the base.

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H	ECO C7	PROJECT 16-403-10
CHECKED BY		FHL EEAP
DATE MARCH 1993	REPLACE ELEC. BOOSTER	
REV. 19	HEATER FOR CAN WASHER	SHEET NO. 2 OF 5 SHEETS

1993 EEAP RECOMMENDATION:

Disconnect electric booster heater to can washer. Interrupt piping from booster heater and connect to DHW supply.

Use Bldg 206 DHW to wash cans. Sanitize cans following washing with a solution of household bleach and water. (Contact "Preventive Medicine" to ascertain water/chlorine bleach mixture requirements.)

Energy Savings Calculation

Electric demand Savings 58.5 KW
cost savings (non-peak demand charge)
$\$.40.80 \times 58.5\,kW = \$ \quad /yr$

Electric use savings: 730 hours of use per year
(verified PG&E assumption)

$730 \times 58.5\,kW \times 0.7 = 29{,}900\,kWH/YR$

diversity for multiple elements

COST Savings @ Year-Round Rate - assumes can washing occurs in non-peak period:

$29{,}900\,kWH \times \$0.06223/kWH = \$ \quad /yr.$

Added No. 2 FO Cost:

$730 \times 58.5 \times 0.7 \times 3413/1{,}000{,}000 = 102 \times 10^6\,BTU/YR$ thermal load.

Estimated HW B/r η = 70.8%

$102/0.708 = 144 \times 10^6\,BTU/YR$ #2 FO needed

Added Fuel Cost $\$7.87/10^6\,BTU \times 144 \times 10^6\,BTU$

$= \$1133/YR.$

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY B/H	ECO C7	PROJECT 16-403-10
CHECKED BY		FNC EEAP
DATE MARCH 1993	REPLACE ELEC. BOOSTER	
REV. 19	HEATER FOR CAN WASHER	SHEET NO. 3 OF 5 SHEETS

SUMMARY ENERGY SAVINGS

		Savings/yr	Unit Cost	Cost Saved
ELECTRIC	DEMAND	58.5 KW	$40.80	$2387
	USE	29,900 KWH	$0.06223	$1861
FUEL OIL		(144 Mil BtU)	$7.87	$(1133)
TOTAL				$3115/YR.

Neglect added cost of bleach as minimal compared to energy cost savings (less than $100/yr)

No need for a special heat exchanger for high temp. water when bleach solution is used.

FORM 101-1/8

CONSTRUCTION COST ESTIMATE	DATE PREPARED FEBRUARY 1993	SHEET 4 OF 5

PROJECT: EEAP LIMITED ENERGY STUDY — PROJ. NO. C7

LOCATION: FORT HUNTER LIGGETT, CALIFORNIA - Bldg 206

ARCHITECT ENGINEER: KELLER & GANNON

BASIS FOR ESTIMATE:
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.: | ESTIMATOR: BJH | CHECKED BY:

Disconnect Booster Heater for Can Washer	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
Disconnect Electric	1	MH	40.1	40	10	10	50
Disconnect Extg Plumb. Connection to Htr	1	MH	41.5	41.5	-	-	42
Install 3/4" CU Pipe from DHW to Can-Wash piping	20	LF	4	80	3	60	140
Insulate 3/4" CU Pipe	20	LF	2.4	48	1.4	28	76
SUBTOTAL			-		-		308
SALES TAX @ 8%			-	-			25
SUBTOTAL			-	-	-	-	333
CONTRACTOR OH & PROFIT @ 30%			-	-	-	-	100
SUBTOTAL			-	-	-	-	433
BOND @ 1%			-	-	-	-	4
SUBTOTAL			-	-	-	-	437
ESTIMATING CONTINGENCY @ 10%			-	-	-	-	44
TOTAL PROBABLE CONSTRUCTION COST			-	-	-	-	481

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO C7
Sheet 5 of 5

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: Remove Electric Booster Heater
Fiscal Year FY96
Discrete Portion Name: ECO# C-7, Bldg 206
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$481		
B. SIOH	$26		
C. Design Cost	$29		
D. Total Cost (1A+1B+1C)	$536		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$536

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	102.0	$2,229	11.70	$26,076
B. Dist	$4.98	(144.0)	($717)	13.78	($9,882)
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	58.5 k	$6,353	11.70	$74,331
E. Other					
F. Total			$7,865		$90,526

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	0.1	Years
5. Total Net Discounted Savings (2F5+3C):	$90,526	
6. Savings to Investment Ratio (SIR) 5/1G:	168.79	
7. Adjusted Internal Rate of Return (AIRR):	1467.00%	

DESCRIPTION OF ACTION

Install a commercial type package heat recovery unit at each dishwashing location in facility 206. The unit extracts waste heat from dishwasher discharge and uses it to preheat cold water make-up.

The Waste Energy Transfer System, Molitor Industries, Inc. recycles 70% to 75% of energy normally wasted.

FACILITIES INCLUDED

DINING FACILITY, BLDG 206

ENERGY SAVING CALCULATION

Refer to attached brochure for supporting data.

DHW to dishwashers is provided at 140 °F from bldg system, fuel oil fired, average thermal efficiency 70.8 %. Of the total DHW heating fuel use of 906 Mil BTU/yr, 50 % is assumed used in dishwashers.

Dishwashers heat DHW from the supply temp. to 180°F for sanitizing, discharge temp. is 180°F.

75% heat recovery is possible:

906×10^6 BTU/Y $\times 0.5 \times 0.708$ = 321×10^6 BTU/YR Thermal load for dishwashing.

75% recovery = 321×0.75 = 240×10^6 BTU/Yr Recovery.

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY B/H	ECO C-8	PROJECT 16.403-10
CHECKED BY	RECOVER HEAT FROM	FHL EEAP
DATE MARCH 1993	DINING FAC. DISHWASHING	
REV. 19		SHEET NO. 2 OF 8 SHEETS

Recovered heat is sent to the DHW makeup;
Avoided use of fuel oil is:

$$\frac{240 \times 10^6 \text{ BTU/yr}}{0.708} = 339 \times 10^6 \text{ BTU/yr FUEL OIL SAVED}$$

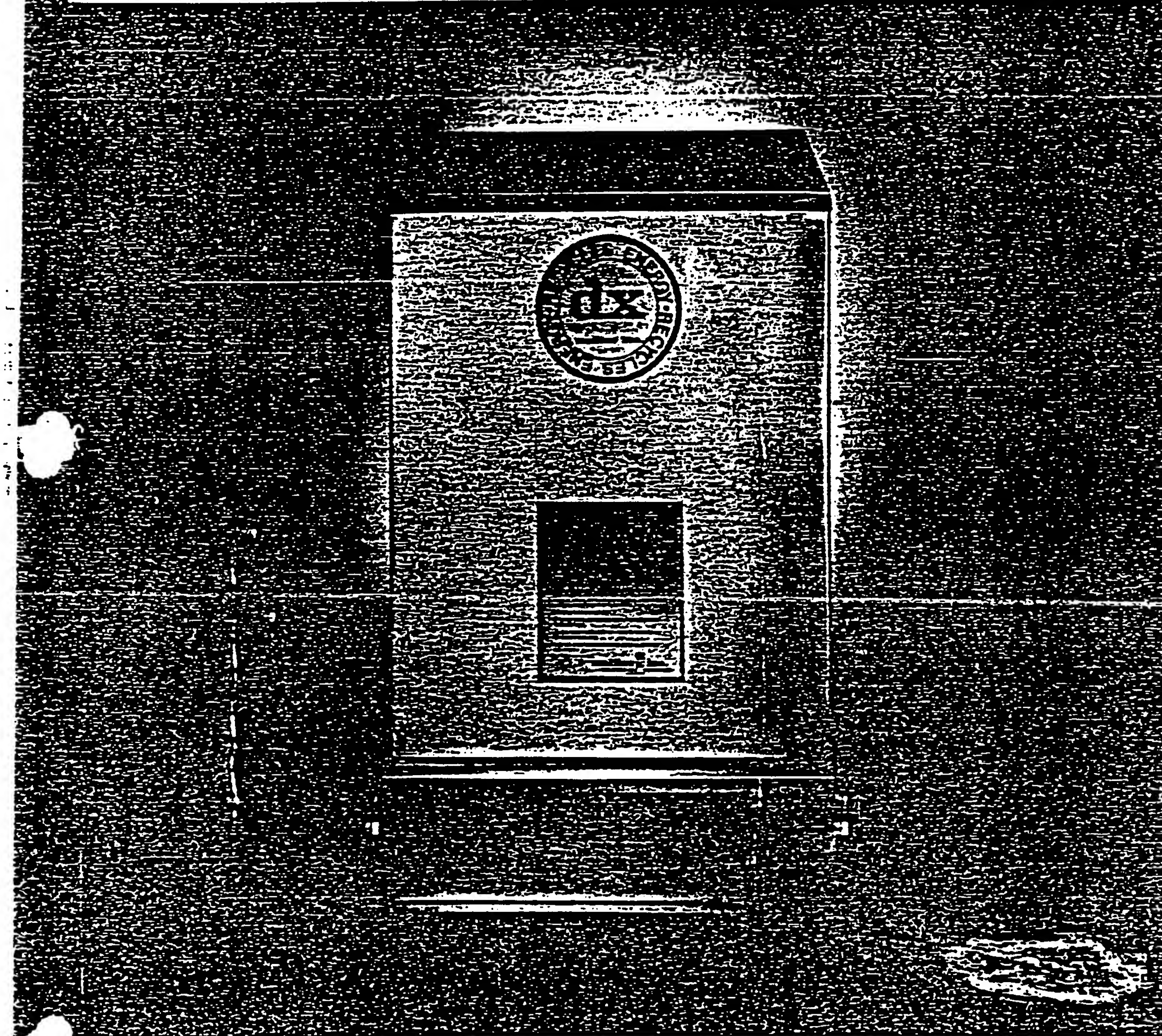
$$\$4.98 \times 339 \times 10^6 \text{ BTU/yr} = \$1688 \text{ /yr SAVED}$$

Allow 4hrs/year @ 40 $/Hr for maintenance, cleaning, etc.
= $160/year.

FORM 101-1/8

Save Millions of BTU's & Hundreds of Dollars Annually

ECO C8 Sheet 3 of 8



The Molitor dx Waste Energy Transfer System

dx-0181

E-9

Waste Energy Transfer System for Commercial Dishwashers can Save Millions of BTU's & Hundreds of Dollars Annually

The Molitor dx Waste Energy Transfer System

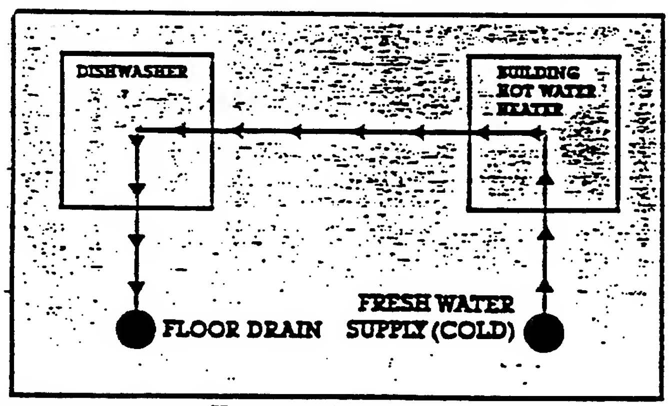
The energy used to heat hot water for washing dishes results in one of the highest energy costs a foodservice operator must face. Even a small commercial dishwasher wastes over 140,000 gallons of hot water each year: that equals over 100 million BTU's down the drain.

Today, Molitor, Inc. has an alternative to wasting that energy — the **Molitor dx Waste Energy Transfer System** for commercial dishwashers. This simple yet effective device recycles 70% to 75% of the energy normally wasted by a dishwasher and returns it to the hot water heater. Here's how it works:

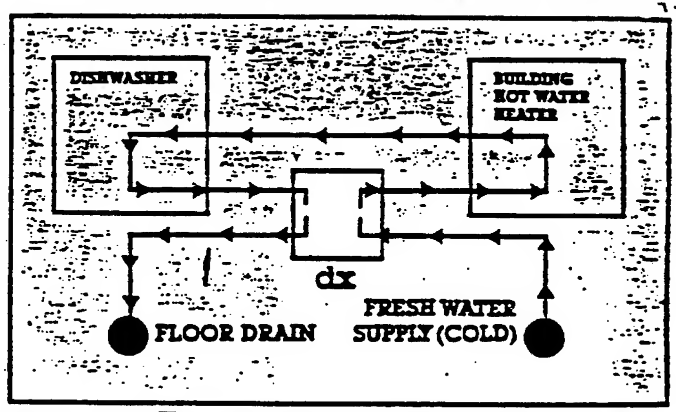
During the dishwasher rinse cycle, the hot waste water normally thrown away now drains into the lower section of the **dx** unit. A switch senses the water and actuates a pump which circulates this hot water through the heat exchanger. At the same time, cold fresh water is moving counterflow through the **dx** where it picks up heat from the waste water. After this transfer takes place, the cooled waste water drains to a normal floor sink and the pre-heated fresh water moves on to the building water heater.

ANNUAL SAVINGS Sample

Gallons Used	BTU's Saved
100,000	63,380,000
300,000	190,140,000
500,000	316,900,000



Without dx : Energy Wasted To Floor Drain



With dx : Energy Recycled To Hot Water Heater

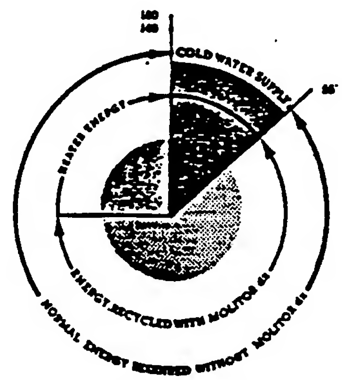
BENEFITS & FEATURES

- Recycles 70% to 75% of the recoverable energy normally wasted by a commercial dishwasher.
- Uses this energy to pre-heat the cold water supply to the building hot water heater.
- Helps solve hot water shortage problems in existing foodservice operations.
- On new installations or remodels, the dx can reduce your hot water heater size.
- Works with both high or low temperature machines.
- Improves grease trap efficiency by reducing waste water temperatures.
- Compact, self-contained unit — fits u dishtable.
- Only two moving parts.
- Easily installed, easily maintained.
- A complete separation of waste and potable water to comply with plumbing sanitation codes. I.A.P.M.O. approved.
- Qualifies for investment and energy tax credits.
- Tested and efficiency certified by an independent testing laboratory. Test data available on request.

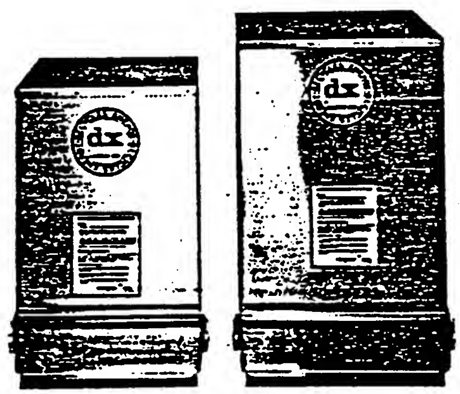
ENERGY SAVINGS

The Molitor dx Waste Energy Transfer System recycles 70% to 75% of the recoverable energy normally wasted by a commercial dishwasher. Depending on business volume, energy costs, and the type of dishwasher, **the dx will pay for itself in 1/2 to 3 years.** As energy costs continue to increase, so do your savings.

A complete, no obligation energy analysis is available for your particular operation. Simply complete the attached reply card and drop it in the mail. See how much you could be saving by RECYCLING ENERGY!



SIZING



The dx Waste Energy Transfer System is available in two standard sizes.

The **dx-2** is designed to work with most single tank, door-type dishmachines and those which use 2 gallons or less during a complete washing cycle.

The **dx-4** is sized for those machines which use up to 6 gallons of water per complete cycle or less than 6 gallons per minute.

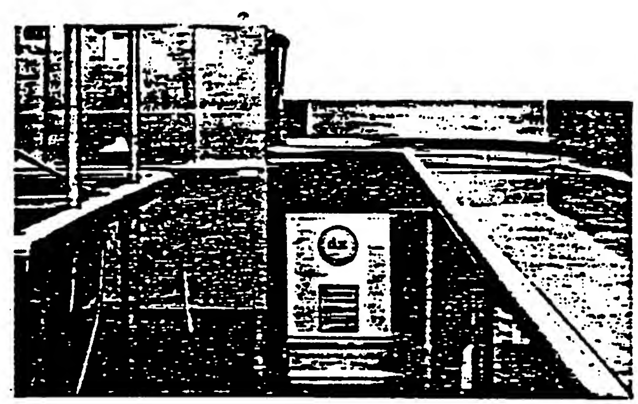
Consult your dishwasher specifications for water usage information or contact Molitor, Inc. for correct sizing.

ENERGY TAX CREDIT

The Molitor dx Waste Energy Transfer System is designed and manufactured for the sole purpose of reducing the amount of energy consumed in any industrial or commercial facility, both new and existing. When installed in connection with an existing facility, the Molitor **dx** is intended to qualify for energy tax credits.

Consult your tax advisor with any specific questions regarding this issue.

SPECIFICATIONS



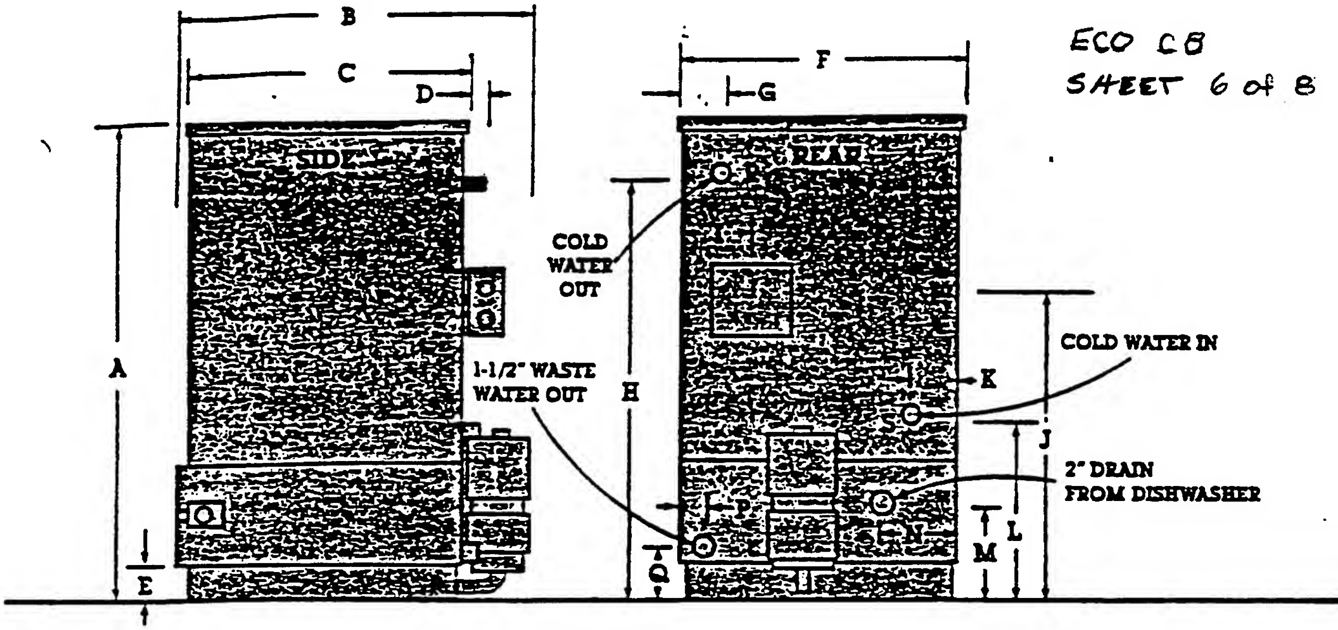
Dishmachine Waste Water Heat Exchanger shall be a self-contained, compact unit sized to fit beneath dishtable adjacent to dishmachine. The unit shall be capable of transferring heat from the hot waste water of the dishmachine to the fresh, incoming water supply for the building water heater. The Heat Exchanger shall be fabricated to provide a complete separation of the fresh, potable water from the dishmachine waste water and shall be approved by the International Association of Plumbing and Mechanical Officials as meeting all requirements of the Uniform Plumbing Code. All electrical components shall be U.L. Classified.

Waste Water Heat Exchanger shall be Molitor dx Series Waste Energy Transfer System as distributed by Molitor, Industries Inc. of Englewood, Colorado 80110.

WARRANTY

The Molitor dx Waste Energy Transfer System carries a one year guarantee on all parts and materials and a 90 day guarantee on labor. Refer to Owners Manual for complete details on this warranty.

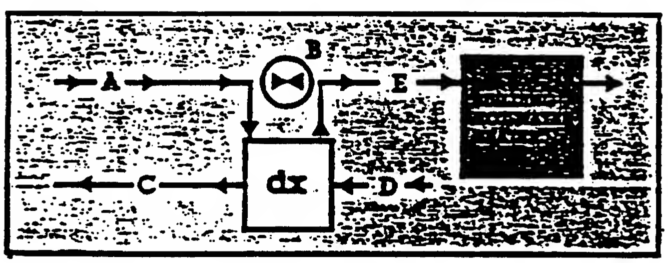
ECO CB
SHEET 6 of 8



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S
dx-2	26½	21	16⅞	2	1½	16½	3½	24⅞	5⅜	18½	2⅜	9⅞	5¼	3½	1½	25½	[illegible]	[illegible]
dx-4	30½	23½	18¾	2	1½	18½	3⅜	28⅞	5¼	16½	3½	9½	5⅞	3½	1½	27½	[illegible]	1½

PLUMBING

The dx unit should be hard piped to ground (cold) water and to the hot water heater. The pre-heated line from the dx to the water heater should be insulated to prevent heat loss. The drain connection from the dishwasher to the dx can be hard piped or hose connected.(Verify with Local Plumbing Code)



ELECTRICAL

Requirements: 120V, 2.1 Amps.

UL LISTED

A. Cold Water Supply.
B. By-Pass Arrangement. Used only when line size to water heater is larger than dx line size.
C. 1-1/2" Indirect Waste Line.
D. 2" Drain from Dishwasher.
E. Pre-heated Water Line to Hot Water Heater (insulated).

MOLITOR PRODUCTS PRODUCED UNDER U.S. AND FOREIGN PATENTS.

The Molitor dx Waste Energy Transfer System is approved by the International Association of Plumbing and Mechanical Officials meeting the requirements of the Uniform Plumbing Code also by the City of Los Angeles, CA Mechanical Inspection Department.

PLUMBING SAFETY IAPMO

MOLITOR INDUSTRIES INC.
dx Division
2829 South Santa Fe Drive
P.O. Box 1218
Englewood, Colorado 80150
303-789-2231 - 800-525-9494
TWX 910-933-0179

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 7 OF 8
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)
Location: Fort Hunter-Liggett, California		
Engineer-Architect: Keller & Gannon		
Drawing No.: ECO-C8 Dishwasher Heat Recovery	Estimator: RJB	Checked By: BIH

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 206							
Molitor or Equal Unit	1	Ea	$352	$352	$1,217	$1,217	$1,569
Drain Piping 2-inch Galv	20	LF	$8.99	$180	$6.78	$136	$315
Water Piping 1-inch CU	130	LF	$6.14	$798	$3.52	$457	$1,256
Pipe Insulation 1-inch @ pipe	130	LF	$2.52	$328	$1.47	$191	$519
Wiring	-	Job	$100	$100	$50	$50	$150
Subtotal Building 206							$3,808
Sales Tax 8%							$305
Contractor O.H. & P 30%							$1,142
Sub Total							$5,255
Bond 1%							$53
Sub Total							$5,308
Estimating Contingency 10%							$531
Total Probable Construction Cost							$5,839

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO C9
Sheet 8 of 8

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: Dishwasher Heat Revovery
Fiscal Year FY96
Discrete Portion Name: ECO# C-8, Bldg 206
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$5,839		
B. SIOH	$321		
C. Design Cost	$350		
D. Total Cost (1A+1B+1C)	$6,510		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$6,510

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	0.0	$0	11.70	$0
B. Dist	$4.98	339.0	$1,688	13.78	$23,263
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	0.0 k	$0	11.70	$0
E. Other					
F. Total			$1,688		$23,263

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($160)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($1,779)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) ($1,779)

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	4.3	Years
5. Total Net Discounted Savings (2F5+3C):	$21,483	
6. Savings to Investment Ratio (SIR) 5/1G:	3.30	
7. Adjusted Internal Rate of Return (AIRR):	25%	

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY JCS
CHECKED BY B/H
DATE FEBRUARY 1993
REV. 19

ECO # C9
AUTOMATIC BOILER FLUE DAMPERS ON DHW SYSTEMS

PROJECT FHL EEAP
V6-403-10

SHEET NO. 1 OF 8 SHEETS

DESCRIPTION OF WORK

THE OPPORTUNITY LOOKS AT THE POTENTIAL ENERGY SAVINGS CREATED BY THE INSTALLATION OF A DAMPER WHICH CLOSES OFF THE FLUE WHEN THE BOILER IS RUNNING IN STANDBY MODE.

ABOUT 2-3% OF THE BOILERS CAPACITY THROUGH LOSSES THROUGH THE FLUE UNDER STANDBY CONDITIONS.

BUILDINGS INCLUDED

SEE ATTACHED PRINT-OUTS

ENERGY SAVINGS CALCULATIONS

ENERGY SAVINGS ARE DETERMINED BY ASSUMING A 1.5% THERMAL EFFICIENCY IMPROVEMENT IN FIRED EQUIPMENT USED TO HEAT DHW. SAVINGS ARE CALCULATED AS FOLLOWS

$$Q_S = Q_0 - Q_0 * \eta_0 / (\eta_0 + 1.5\%)$$

WHERE: Q_S = FUEL SAVINGS

Q_0 = BASELINE (AFTER REDUCTION OF DHW TEMPS. TO AUTH. LEVELS @ ECO C-1) FUEL USE

η_0 = BASELINE DHW HEATING EFFICIENCY

FORM 101-1/8

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 3 OF 8	
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO-C9 Install Automatic Flue Dampers on	Estimator: RJB	Checked By: BIH	

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
GAS FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	$32	$134	$134	$166
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 4-inch Flue, Gas Fired							$346
Sales Tax 8%							$28
Contractor O.H. & P 30%							$104
Sub Total							$478
Bond 1%							$5
Sub Total							$483
Estimating Contingency 10%							$48
Total Probable Construction Cost							$531
6-inch Diameter Auto-Damper	1	Ea	34.90	$35	$138	$138	$173
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 6-inch Flue, Gas Fired							$353
Sales Tax 8%							$28
Contractor O.H. & P 30%							$106
Sub Total							$487
Bond 1%							$5
Sub Total							$492
Estimating Contingency 10%							$49
Total Probable Construction Cost							$541
8-inch Diameter Auto-Damper	1	Ea	38.40	$38	$152	$152	$190
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 8-inch Flue, Gas Fired							$370
Sales Tax 8%							$30
Contractor O.H. & P 30%							$111
Sub Total							$511
Bond 1%							$5
Sub Total							$516
Estimating Contingency 10%							$52
Total Probable Construction Cost							$568

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: February 1993	Sheet 3 OF 6	
Project: EEAP Limited Energy Study	Project No.: 16-403-10	Basis for Estimate: Code A (no design competed)	
Location: Fort Hunter-Liggett, California			
Engineer-Architect: Keller & Gannon			
Drawing No.: ECO-C9 Install Automatic Flue Dampers on	Estimator: RJB	Checked By: BIH	

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
OIL FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	$32	$156	$156	$188
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 4-inch Flue, Oil Fired							$368
Sales Tax 8%							$29
Contractor O.H. & P 30%							$29
Sub Total							$426
Bond 1%							$4
Sub Total							$431
Estimating Contingency 10%							$43
Total Probable Construction Cost							$474
6-inch Diameter Auto-Damper	1	Ea	34.90	$35	$161	$161	$196
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 6-inch Flue, Oil Fired							$376
Sales Tax 8%							$30
Contractor O.H. & P 30%							$113
Sub Total							$519
Bond 1%							$5
Sub Total							$524
Estimating Contingency 10%							$52
Total Probable Construction Cost							$576
8-inch Diameter Auto-Damper	1	Ea	38.40	$38	$161	$161	$199
Relay & Wiring	-	Job	-	$120	-	$60	$180
Subtotal 8-inch Flue, Oil Fired							$379
Sales Tax 8%							$30
Contractor O.H. & P 30%							$114
Sub Total							$524
Bond 1%							$5
Sub Total							$529
Estimating Contingency 10%							$53
Total Probable Construction Cost							$582

Fac No.	Installation Name	ECO C-9 Incl.	ECO C9 Energy Savings: Automatic Flue Dampers									
			Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Constr Cost	Investment	SIR
T 6	**Family Housing NCO & Enl**	Yes	-	1.07	-	$0	$8	$0	$120	$531	$592	0.20
P 41A	**Family Housing NCO & Enl**		-	-	-	$0	$0	$0	$0	-	-	-
P 41B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 42A	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 42B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 43A	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 43B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 44A	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 44B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 45A	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 45B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 46	**Family Housing CG & WO**		-	-	-	$0	$0	$0	$0	-	-	-
P 47	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 51A	**Family Housing NCO & Enl**		-	-	-	$0	$0	$0	$0	-	-	-
P 51B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 52A	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 52B	Family Housing NCO & Enl		-	-	-	$0	$0	$0	$0	-	-	-
P 53	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 54	**Family Housing CG & WO**		-	-	-	$0	$0	$0	$0	-	-	-
P 55	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 56	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 57	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 58	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 59	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
P 60	Family Housing CG & WO		-	-	-	$0	$0	$0	$0	-	-	-
S 79	Post Office, Main		-	-	-	$0	$0	$0	$0	-	-	-
P 80	**Exchange, Main Retail**		-	-	-	$0	$0	$0	$0	-	-	-
P 81	**Theater with Dressing Rm's**		-	-	-	$0	$0	$0	$0	-	-	-
P 101	**Open Din Cons (Hacienda)**	Yes	-	2.59	-	$0	$20	$0	$289	$568	$633	0.46
	Club (Bar)	Yes	-	0.50	-	$0	$4	$0	$56	$531	$592	0.09
	Hacienda, Dwellings	Yes	-	1.57	-	$0	$12	$0	$175	$568	$633	0.28
		Yes	-	2.41	-	$0	$19	$0	$269	$568	$633	0.42
P 116	**Exchange Service Station**		-	-	-	$0	$0	$0	$0	-	-	-
	(Non-shop areas)		-	-	-	$0	$0	$0	$0	-	-	-
T 120	**Fire Station - Office**	Yes	-	0.68	-	$0	$5	$0	$76	$568	$633	0.12
	Fire Station - Dorm	Yes	-	4.01	-	$0	$32	$0	$447	$568	$633	0.71
	Fire Station - Garage		-	-	-	$0	$0	$0	$0	-	-	-

ECO C-9 Sheet 4 of 8

Eco C-9 Sheet 5 of 8

Fac No.	Installation Name	ECO C-9 Incl.	ECO C9 Energy Savings: Automatic Flue Dampers									
			Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Constr Cost	Investment	SIR
T 121	Bowling Center	Yes	-	0.90	-	$0	$7	$0	$100	$531	$592	0.17
			-	-	-	$0	$0	$0	$0	-	-	-
T 124	Family Housing LC & MJ	Yes	-	2.15	-	$0	$17	$0	$240	$531	$592	0.40
T 127	Officers Quarters Military	Yes	-	2.49	-	$0	$20	$0	$278	$568	$633	0.44
P 128	Officers Quarters Military	Yes	-	15.78	-	$0	$124	$0	$1,759	$568	$633	2.78
T 131	Family Housing CG & WO	Yes	-	2.23	-	$0	$18	$0	$249	$531	$592	0.42
S 144	Gymnasium		-	-	-	$0	$0	$0	$0	-	-	-
S 146	FE Facility		-	-	-	$0	$0	$0	$0	-	-	-
T 149	Family Housing NCO & Enl	Yes	-	2.12	-	$0	$17	$0	$236	$531	$592	0.40
T 156	FE Facility - Shop		-	-	-	$0	$0	$0	$0	-	-	-
	FE Facility - Office		-	-	-	$0	$0	$0	$0	-	-	-
T 158	Vehicle Storage		-	-	-	$0	$0	$0	$0	-	-	-
T 161	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
T 162	Elec Maint. Shop		-	-	-	$0	$0	$0	$0	-	-	-
T 163	Officers Quarters Military		-	-	-	$0	$0	$0	$0	-	-	-
T 164	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
T 165	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
T 166	Officers Quarters Military		-	-	-	$0	$0	$0	$0	-	-	-
T 167	Officers Quarters Military		-	-	-	$0	$0	$0	$0	-	-	-
S 168	General Purp Warehouse		-	-	-	$0	$0	$0	$0	-	-	-
T 172	Cold Storage Warehouse		-	-	-	$0	$0	$0	$0	-	-	-
P 177	Technical Library		-	-	-	$0	$0	$0	$0	-	-	-
P 178	Child Development Cntr		-	-	-	$0	$0	$0	$0	-	-	-
S 182	Commissary		-	-	-	$0	$0	$0	$0	-	-	-
S 186	Sup Svc Admin Bldg		-	-	-	$0	$0	$0	$0	-	-	-
P 190	Post Chapel		-	-	-	$0	$0	$0	$0	-	-	-
S 197	Admin Bldg R&D - Office		-	-	-	$0	$0	$0	$0	-	-	-
	Admin Bldg R&D - Electronics		-	-	-	$0	$0	$0	$0	-	-	-
S 198	General Inst Bldg		-	-	-	$0	$0	$0	$0	-	-	-
P 205	Admin General Purpose	Yes	1.52	-	-	$8	$0	$0	$104	$582	$649	0.16
P 205A	Company HQ Building		-	-	-	$0	$0	$0	$0	-	-	-
P 206	Enlisted Pers Dining Fac	Yes	18.78	-	-	$94	$0	$0	$1,289	$1,164	$1,298	0.99
	Kitchen Area - Scullery		-	-	-	$0	$0	$0	$0	-	-	-
P 207	Enl Barracks w/o Dining	Yes	7.20	-	-	$36	$0	$0	$494	$582	$649	0.76
P 207A	Company HQ Building		-	-	-	$0	$0	$0	$0	-	-	-
P 208	Enl Barracks w/o Dining	Yes	7.70	-	-	$38	$0	$0	$528	$582	$649	0.81
P 208A	Company HQ Building		-	-	-	$0	$0	$0	$0	-	-	-

Fac No.	Installation Name	ECO C-9 Incl.	ECO C9 Energy Savings: Automatic Flue Dampers Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Constr Cost	Investment	SIR
P 209	**AAFES Snack Bar**		-	-	-	$0	$0	$0	$0	-	-	-
P 210	**Hlth/Dntl Clinic w/ Beds**	Yes	51.02	-	-	$254	$0	$0	$3,501	$576	$642	5.45
P 211	Outdoor Swimming Pool		-	-	-	$0	$0	$0	$0	-	-	-
P 212	**Gymnasium**	Yes	-	0.48	-	$0	$4	$0	$53	$541	$603	0.09
P 219	Physical Fitness Center	Yes	-	1.31	-	$0	$10	$0	$145	$541	$603	0.24
P 229	**Enl Barracks w/o Dining**	Yes	3.43	-	-	$17	$0	$0	$235	$582	$649	0.36
P 229A	Company HQ Building		-	-	-	$0	$0	$0	$0	-	-	-
P 230	**Enl Barracks w/o Dining**	Yes	6.91	-	-	$34	$0	$0	$474	$582	$649	0.73
P 230A	Company HQ Building		-	-	-	$0	$0	$0	$0	-	-	-
S 235	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 236	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 237	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 238	**Sig Photo Lab**	Yes	-	0.95	-	$0	$7	$0	$105	$541	$603	0.17
	Process	Yes	-	8.34	-	$0	$66	$0	$929	-	-	-
P 240	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 241	**GM Facility**		-	-	-	$0	$0	$0	$0	-	-	-
			-	-	-	$0	$0	$0	$0	-	-	-
			-	-	-	$0	$0	$0	$0	-	-	-
			-	-	-	$0	$0	$0	$0	-	-	-
S 243	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 244	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 246	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
S 247	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
P 252	**Vehicle Maint Shop DS**		-	-	-	$0	$0	$0	$0	-	-	-
P 256	Vehicle Maint Shop ORG		-	-	-	$0	$0	$0	$0	-	-	-
P 259	Vehicle Maint Shop ORG		-	-	-	$0	$0	$0	$0	-	-	-
S 283	**FE Maintenance Shop**		-	-	-	$0	$0	$0	$0	-	-	-
			-	-	-	$0	$0	$0	$0	-	-	-
S 286	Admin General Purpose		-	-	-	$0	$0	$0	$0	-	-	-
P 287	**Recreation Building**	Yes	-	1.06	-	$0	$8	$0	$118	$531	$592	0.20
S 288	General Purpose Warehouse		-	-	-	$0	$0	$0	$0	-	-	-
S 290	**Electron Equip Facility**	Yes	-	1.46	-	$0	$11	$0	$162	$541	$603	0.27
			-	-	-	$0	$0	$0	$0	-	-	-
S 291	**Cont Humid Warehouse**		-	-	-	$0	$0	$0	$0	-	-	-
P 295	**Enl Barracks w/o Dining**	Yes	-	15.21	-	$0	$120	$0	$1,696	$568	$633	2.68
P 301	**ADP Building**		-	-	-	$0	$0	$0	$0	-	-	-
			-	-	-	$0	$0	$0	$0	-	-	-
			-	-	-	$0	$0	$0	$0	-	-	-

ECO E-9 Sheet 6 of 8

ECO C-9
Sheet 7 of 8

Fac No.	Installation Name	ECO C-9 Incl.	ECO C9 Energy Savings: Automatic Flue Dampers Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric MW-Hr/Yr	FO Ann. $ Savings	Prop. Ann. $ Savings	Elec. Ann. $ Savings	LCC Savings	Constr Cost	Investment	SIR
P 642	**Detached Latrine/Shower**	Yes	-	2.18	-	$0	$17	$0	$243	$531	$592	0.41
S 2201	**Control Tower - Range SPT**		-	-	-	$0	$0	$0	$0	-	-	-
SIR>1 Totals			51.0	31.0	0.0	$254	$244	$0	$6,955	$1,712	$1,909	3.64
						Totals for SIR > 1 Bldgs:			128, 210 and 295 only			

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO C9
Sheet 8 of 8

Location: Fort Hunter Liggett, California Region No. 4 Project No. 16-403-10
Project Title: ~~Add Zone Optimizer Control~~ Automatic Flue Dampers Fiscal Year FY96
Discrete Portion Name: ~~ECO# B-18, Bldg 81~~ C-9
Analysis Date: March 1993 Economic Life: 15 YEARS Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$1,712		
B. SIOH	$94		
C. Design Cost	$103		
D. Total Cost (1A+1B+1C)	$1,909		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$1,909

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	0.0	$0	11.70	$0
B. Dist	$4.98	51.0	$254	13.78	$3,500
C. Propane	$7.87	31.0	$244	14.16	$3,455
D. Demand	$108.60	0.0 k	$0	11.70	$0
E. Other					
F. Total			$498		$6,954

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 3.8 Years
5. Total Net Discounted Savings (2F5+3C): $6,954
6. Savings to Investment Ratio (SIR) 5/1G: 3.64
7. Adjusted Internal Rate of Return (AIRR):

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RCL
CHECKED BY
DATE FEBRUARY 1993
REV. 19

RETROFIT EXTERIOR LIGHTING WITH HPS FIXTURES
ECO # D3

PROJECT 16-403-10

SHEET NO. 1 OF 1 SHEETS

DESCRIPTION OF ACTION

THIS ECO REPLACES EXISTING MERCURY VAPOR AND QUARTZ EXTERIOR LUMINAIRES WITH MORE EFFICIENT HIGH PRESSURE SODIUM UNITS. RETROFITS EVALUATED INCLUDE THE FOLLOWING ONE-FOR-ONE REPLACEMENTS:

NO.	EXISTING	PROPOSED	INITIAL LUMENS % CHANGE	RETROFIT
A.	175W MV	100W HPS	+12	BALLAST + LAMP
B.	250W MV	150W HPS	+23	↓
C.	400W MV	250W HPS	+22	↓
D.	1000W QUARTZ	200W HPS	+1	NEW LUMINAIRE (FIELDS & COURTS)

UNIT RETROFIT LCC ANALYSIS

NO	EXIST WATTS	PROPOSED WATTS	REDUCTION KW	OP HOURS/YR	USE FACTOR	ANNUAL SAVINGS KWH
A	197	130	.067	4,160	.70	195
B.	285	173	.112	4,160	.70	326
C.	469	302	.167	4,160	.70	486
D.	1000	240	.760	200	1.00	152

NO.	MAT'L $	LABOR $	PG&E REBATE	TOTAL 1) INVEST.	O&M 2) SAVINGS (LCC)	KW SAVINGS 3) (LCC)	KWH 4) SAVINGS (LCC)	TOTAL SAVINGS (LCC)	SIR
A	186	34	30	348	(64)	30	142	108	0.31
B	198	36	40	362	(35)	51	237	253	0.70
C	266	37	60	462	(56)	76	354	374	0.81
D	330	107	60	686	38	345	111	494	0.72

95.74
72.14

1) INVESTMENT = $\{[(\text{MAT'L} \times 1.08) + \text{LABOR}] \times 1.30 \times 1.01 \times 1.10 \times 1.115\} - \text{PG\&E REBATE}$

2) O&M SAVINGS = $\left\{\left(\frac{\text{OP. HOURS}}{\text{EXIST LAMP LIFE}} \times \text{COST OF RELAMPING}\right) - \left(\frac{\text{OP. HOURS}}{\text{NEW LAMP LIFE}} \times \text{COST OF RELAMPING}\right)\right\} \times 11.12 \text{ UPW}$

3) KW SAVINGS = KW SAVINGS x *40.80/KW x 11.12 UPW*

4) KWH SAVINGS = KWH SAVINGS x *0.06223/KWH x 11.70 UPW*

BASED ON THE ABOVE UNIT ANALYSIS, THIS MEASURE IS NOT COST EFFECTIVE.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL CHECKED BY DATE FEBRUARY 1993 REV. JUNE 1993	REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT ECO # D4	PROJECT 16-403-10 SHEET NO. 1 OF 35 SHEETS

DESCRIPTION OF ACTION

THIS PROJECT WOULD REPLACE INEFFICIENT INCANDESCENT FIXTURES WITH EFFICIENT COMPACT FLUORESCENT FIXTURES OR FOUR-FOOT FIXTURES WITH ELECTRONIC BALLASTS AND T8 LAMPS. REPLACEMENTS ANALYZED ARE AS FOLLOWS:

DATA & ASSUMPTIONS

	EXISTING INCANDESCENT			REPLACEMENT FLUORESCENT			
DESIG.	WATTS	MEAN LIFE (HRS)	RELAMPING COST	TYPE	WATTS	MEAN LIFE	RELAMP. COST
A	60	1000	1.50 + 1.50 LABOR	13W/5T4	17	10,000	10.00 + 3.00 LAB
B	75	750	1.50 + 1.50 LABOR	18W/7T4	25	10,000	10.00 + 3.00 LAB
C	100	750	2.00 + 1.50 LABOR	18W/7T4	25	10,000	10.00 + 3.00 LAB
D	150	750	2.40 + 1.50 LABOR	26W/8T4	37	10,000	15.00 + 3.00 LAB
E	250	750	2.75 + 1.50 LABOR	2-F32/T8	61	20,000	8.00 + 5.25 LAB
F	300	750	4.45 + 1.50 LABOR	2-F32/T8	61	20,000	8.00 + 5.25 LAB

SCREENING ANALYSIS

DESIG.	KW SAVINGS	LABOR COST	MAT'L COST	TOTAL COST 1/	PG&E REBATE	TOTAL INVEST. 3/	BREAKEVEN OP HOURS/YEAR
A	0.043	35	40	130	15	115	1,070
B	0.050	35	40	130	15	115	825
C	0.075	35	40	130	15	115	190
D	0.113	44	60	181	15	166	220
E	0.189	50	75	217	25	192	0
F	0.239	50	75	217	25	192	0

1/ TOTAL COST = (LABOR + MAT'L) × 1.08 × 1.30 × 1.01 × 1.10 × 1.115

2/ BREAKEVEN OP HOURS/YEAR = $\dfrac{\text{TOTAL INVESTMENT} - (\text{KW SAVINGS} \times \$108.60/\text{KW} \times 11.70)}{\text{KW SAVINGS} \times \$0.07454 \times 11.70 + \left(\frac{\text{RELAMP \$}}{\text{M.L.}_1} - \frac{\text{RELAMP \$}}{\text{M.L.}_2}\right) 11.12}$

3/ TOTAL INVESTMENT = TOTAL COST − PG&E REBATE

NOTE: ANALYSIS SUMMARIES ON SHEETS 3 THROUGH 7
DETAILED ANALYSES PER RETROFIT TYPE: SHEETS 8 THROUGH 31
CATALOG CUTS: SHEETS 32 THROUGH 35

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RCL CHECKED BY DATE REV. JUNE 1993 REV. 19	REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT ECO #D4	PROJECT FtL EEAP SHEET NO. 2 OF 35 SHEETS

ADDITIONAL ASSUMPTIONS ARE AS FOLLOWS:

1. HOURS OF LAMP OPERATION BASED ON FIELD SURVEY DATA.
2. ANNUAL USAGE SAVINGS = NO. FIXTURES x KW SAVINGS/FIXT x OP HRS/YR.
3. ANNUAL USAGE COST SAVINGS = KWH x \$0.07454
4. ANNUAL O&M COST SAVINGS = OP HRS/YR x $\left(\frac{\text{RELAMP COST}_{\text{EXIST}}}{\text{MEAN LIFE}_{\text{EXIST}}} - \frac{\text{RELAMP COST}_{\text{RETROFIT}}}{\text{MEAN LIFE}_{\text{RETROFIT}}}\right)$
5. LCC SAVINGS = ANNUAL O&M COST SAVINGS x 11.12 + ANNUAL KWH COST SAVINGS x 11.70 + ANNUAL KW COST SAVINGS x 11.70.

WHERE ANNUAL KW COST SAVINGS = KW SAVINGS x \$108.60

THE PROPOSED RETROFITS ARE DESCRIBED AS FOLLOWS:

RETROFITS A, B AND C: REPLACE EXISTING SURFACE-MOUNTED INCANDESCENT FIXTURE WITH 60-100W LAMPS WITH COMPACT FLUORESCENT FIXTURE WITH 13W/5T4 TO 18W/7T4 LAMP

RETROFIT D: RETROFIT EXISTING RECESSED INCANDESCENT DOWNLIGHT (150W LAMP) WITH FLUORESCENT BALLAST AND SOCKET ADAPTER FOR 26W/8T4 QUAD LAMP.

RETROFIT E AND F: REPLACE EXISTING SUSPENDED INCANDESCENT FIXTURE (250-300W LAMPS) WITH INDUSTRIAL PENDANT-MOUNTED FLUORESCENT FIXTURE CONTAINING 2-F32/T8 LAMPS AND ELECTRONIC BALLAST.

FORM 101-1/8

ECO D-4
SHEET 3 OF 35

SUMMARY OF ECO D-4: REPLACE INCANDESCENT LIGHTING WITH FLUORESCENTS

ECO No.	SUMMARY OF ECO D4 ANALYSES Energy Savings Fxtrs	kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
A: I-60W Savings	181	22,623	8	$1,686	$845	$894	$39,564	$21,175	$23,610	$2,715	$20,895	1.89
B: I-75W Savings	2	208	0.1	$16	$11	$11	$433	$234	$261	$30	$231	1.88
C: I-100W Savings	27	4,922	2	$367	$220	$221	$9,322	$3,159	$3,522	$405	$3,117	2.99
D: I-150W Savings	31	7,286	4	$543	$380	$219	$13,243	$5,029	$5,607	$465	$5,142	2.58
E: I-250W Savings	20	7,862	4	$586	$411	$208	$13,976	$3,900	$4,348	$500	$3,848	3.63
F: I-300W Savings	23	4,124	5	$307	$597	$125	$11,976	$4,485	$5,000	$575	$4,425	2.71
TOTALS	284	47,025	23	$3,505	$2,464	$1,680	$88,515	$37,981	$42,348	$4,690	$37,658	2.35

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent — Fiscal Year FY96
Discrete Portion Name: TOTAL PROJECT
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$37,981		
B. SIOH	$2,089		
C. Design Cost	$2,279		
D. Total Cost (1A+1B+1C)	$42,348		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($4,690)	
G. Total Investment (1D-1E-1F)			$37,658

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	160.5		$3,505	11.70	$41,011
B. Dist	$4.98	0.0		$0	13.78	$0
C. Propane	$7.87	0.0		$0	14.16	$0
D. Demand	$108.60	22.7	kW	$2,464	11.70	$28,828
E. Other						
F. Total				$5,969		$69,839

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$1,680		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$18,677

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $18,677

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	4.9	Years
5. Total Net Discounted Savings (2F5+3C):	$88,515	
6. Savings to Investment Ratio (SIR) 5/1G:	2.35	
7. Adjusted Internal Rate of Return (AIRR):	10.10%	

ECO D-4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: SUMMARY OF TOTAL PROJECT

Fac No.	SIR > 1.0 D4A Energy Savings kWH/Y	kW Demand	SIR > 1.0 D4B Energy Savings kWH/Y	kW Demand	SIR > 1.0 D4C Energy Savings kWH/Y	kW Demand	SIR > 1.0 D4D Energy Savings kWH/Y	kW Demand	SIR > 1.0 D4E Energy Savings kWH/Y	kW Demand	SIR > 1.0 D4F Energy Savings kWH/Y	kW Demand	SIR > 1.0 D4 All Energy Savings kWH/Yr	kW Demand
T 6	-	-	-	-	131	0.2	-	-	-	-	-	-	131	0.2
P 41A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 41B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 42A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 42B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 43A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 43B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 44A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 44B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 45A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 45B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 46	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 47	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 51A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 51B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 52A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 52B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 56	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 57	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 58	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 79	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 80	-	-	-	-	98	0.2	-	-	-	-	-	-	98	0.2
P 81	-	-	-	-	-	-	-	-	-	-	783	4.8	783	4.8
P 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 116	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 120	1,803	0.4	-	-	349	0.1	-	-	-	-	3,341	0.7	5,493	1.2
T 121	250	0.1	-	-	218	0.1	-	-	-	-	-	-	469	0.2
T 124	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 127	2,892	0.9	-	-	3,123	1.0	-	-	-	-	-	-	6,016	1.9
P 128	6,887	2.2	-	-	-	-	-	-	-	-	-	-	6,887	2.2
T 131	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 144	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ECO D-4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: SUMMARY OF TOTAL PROJECT

Fac No.	SIR > 1.0 D4A Energy Savings kWH/Y	SIR > 1.0 D4A Energy Savings kW Demand	SIR > 1.0 D4B Energy Savings kWH/Y	SIR > 1.0 D4B Energy Savings kW Demand	SIR > 1.0 D4C Energy Savings kWH/Y	SIR > 1.0 D4C Energy Savings kW Demand	SIR > 1.0 D4D Energy Savings kWH/Y	SIR > 1.0 D4D Energy Savings kW Demand	SIR > 1.0 D4E Energy Savings kWH/Y	SIR > 1.0 D4E Energy Savings kW Demand	SIR > 1.0 D4F Energy Savings kWH/Y	SIR > 1.0 D4F Energy Savings kW Demand	SIR > 1.0 D4 All Energy Savings kWH/Yr	SIR > 1.0 D4 All Energy Savings kW Demand
S 146	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 149	-	-	-	-	66	0.1	-	-	-	-	-	-	66	0.1
T 156	80	0.0	-	-	-	-	-	-	-	-	-	-	80	0.0
T 158	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 161	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 162	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 163	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 164	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 165	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 166	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 167	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 168	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T 172	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 177	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 178	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 182	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 186	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 190	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 197	1,046	0.6	-	-	-	-	-	-	-	-	-	-	1,046	0.6
S 198	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 205	429	0.1	-	-	-	-	-	-	-	-	-	-	429	0.1
P 205A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 206	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 207	413	0.1	-	-	-	-	-	-	-	-	-	-	413	0.1
P 207A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 208	413	0.1	-	-	-	-	-	-	-	-	-	-	413	0.1
P 208A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 209	1,831	1.7	-	-	-	-	-	-	-	-	-	-	1,831	1.7
P 210	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 211	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 212	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 219	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 229	413	0.1	-	-	-	-	-	-	-	-	-	-	413	0.1
P 229A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 230	413	0.1	-	-	-	-	-	-	-	-	-	-	413	0.1
P 230A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 235	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ECO D-4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: SUMMARY OF TOTAL PROJECT

Fac	SIR > 1.0 D4A Energy Savings		SIR > 1.0 D4B Energy Savings		SIR > 1.0 D4C Energy Savings		SIR > 1.0 D4D Energy Savings		SIR > 1.0 D4E Energy Savings		SIR > 1.0 D4F Energy Savings		SIR > 1.0 D4 All Energy Savings	
No.	kWH/Y	kW Demand	kWH/Y	kW Demand	kWH/Y	kW Demand	kWH/Y	kW Demand	kWH/Y	kW Demand	kWH/Y	kW Demand	kWH/Yr	kW Demand
S 236	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 237	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 238	-	-	-	-	-	-	7,286	3.5	-	-	-	-	7,286	3.5
P 240	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 241	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 243	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 244	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 246	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 247	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 252	89	0.0	-	-	-	-	-	-	3,538	1.7	-	-	3,628	1.7
P 256	-	-	208	0.1	-	-	-	-	393	0.2	-	-	601	0.3
P 259	89	0.0	-	-	-	-	-	-	3,931	1.9	-	-	4,021	1.9
S 283	-	-	-	-	936	0.5	-	-	-	-	-	-	936	0.5
S 286	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 287	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 288	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 290	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 291	161	0.1	-	-	-	-	-	-	-	-	-	-	161	0.1
P 295	5,409	1.2	-	-	-	-	-	-	-	-	-	-	5,409	1.2
P 301	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P 642	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S 2201	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	22,623	7.8	208	0.1	4,922	2.0	7,286	3.5	7,862	3.8	4,124	5.5	47,025	22.7

ECO D-4A REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 60 W to 13W/5T4

Fac No.	A: I-60W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
T 6	10	376	0.4	$28	$47	$14.85	$1,039	$1,170	$1,304	$150	$1,154	0.90
P 41A	0	0	0.0	$0	$0	$0.00	$0					
P 41B	0	0	0.0	$0	$0	$0.00	$0					
P 42A	0	0	0.0	$0	$0	$0.00	$0					
P 42B	0	0	0.0	$0	$0	$0.00	$0					
P 43A	0	0	0.0	$0	$0	$0.00	$0					
P 43B	0	0	0.0	$0	$0	$0.00	$0					
P 44A	0	0	0.0	$0	$0	$0.00	$0					
P 44B	0	0	0.0	$0	$0	$0.00	$0					
P 45A	0	0	0.0	$0	$0	$0.00	$0					
P 45B	0	0	0.0	$0	$0	$0.00	$0					
P 46	0	0	0.0	$0	$0	$0.00	$0					
P 47	0	0	0.0	$0	$0	$0.00	$0					
P 51A	0	0	0.0	$0	$0	$0.00	$0					
P 51B	0	0	0.0	$0	$0	$0.00	$0					
P 52A	0	0	0.0	$0	$0	$0.00	$0					
P 52B	0	0	0.0	$0	$0	$0.00	$0					
P 53	0	0	0.0	$0	$0	$0.00	$0					
P 54	0	0	0.0	$0	$0	$0.00	$0					
P 55	0	0	0.0	$0	$0	$0.00	$0					
P 56	0	0	0.0	$0	$0	$0.00	$0					
P 57	0	0	0.0	$0	$0	$0.00	$0					
P 58	0	0	0.0	$0	$0	$0.00	$0					
P 59	0	0	0.0	$0	$0	$0.00	$0					
P 60	0	0	0.0	$0	$0	$0.00	$0					
S 79	0	0	0.0	$0	$0	$0.00	$0					
P 80	1	19	0.0	$1	$5	$0.74	$79	$117	$130	$15	$115	0.69
P 81	0	0	0.0	$0	$0	$0.00	$0					
P 101	212	2,986	9.1	$223	$990	$118.07	$15,500	$24,802	$27,654	$3,180	$24,474	0.63
P 116	0	0	0.0	$0	$0	$0.00	$0					
T 120	9	1,803	0.4	$134	$42	$71.29	$2,857	$1,053	$1,174	$135	$1,039	2.75
T 121	2	250	0.1	$19	$9	$9.90	$438	$234	$261	$30	$231	1.90
T 124	0	0	0.0	$0	$0	$0.00	$0					
T 127	21	2,892	0.9	$216	$98	$114.35	$4,942	$2,457	$2,739	$315	$2,424	2.04
P 128	50	6,887	2.2	$513	$233	$272.27	$11,766	$5,849	$6,522	$750	$5,772	2.04
T 131	0	0	0.0	$0	$0	$0.00	$0					
S 144	36	0	1.5	$0	$168	$0.00	$1,967	$4,212	$4,696	$540	$4,156	0.47

ECO D-4A REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 60 W to 13W/5T4

Fac No.	A: I-60W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 146	0	0	0.0	$0	$0	$0.00	$0					
T 149	10	376	0.4	$28	$47	$14.85	$1,039	$1,170	$1,304	$150	$1,154	0.90
T 156	1	80	0.0	$6	$5	$3.18	$160	$117	$130	$15	$115	1.39
T 158	0	0	0.0	$0	$0	$0.00	$0					
T 161	0	0	0.0	$0	$0	$0.00	$0					
T 162	0	0	0.0	$0	$0	$0.00	$0					
T 163	0	0	0.0	$0	$0	$0.00	$0					
T 164	0	0	0.0	$0	$0	$0.00	$0					
T 165	0	0	0.0	$0	$0	$0.00	$0					
T 166	0	0	0.0	$0	$0	$0.00	$0					
T 167	0	0	0.0	$0	$0	$0.00	$0					
S 168	0	0	0.0	$0	$0	$0.00	$0					
T 172	0	0	0.0	$0	$0	$0.00	$0					
P 177	0	0	0.0	$0	$0	$0.00	$0					
P 178	0	0	0.0	$0	$0	$0.00	$0					
S 182	0	0	0.0	$0	$0	$0.00	$0					
S 186	0	0	0.0	$0	$0	$0.00	$0					
P 190	4	81	0.2	$6	$19	$3.22	$325	$468	$522	$60	$462	0.70
S 197	13	1,046	0.6	$78	$61	$41.37	$2,083	$1,521	$1,696	$195	$1,501	1.39
S 198	0	0	0.0	$0	$0	$0.00	$0					
P 205	3	429	0.1	$32	$14	$16.97	$727	$351	$391	$45	$346	2.10
P 205A	0	0	0.0	$0	$0	$0.00	$0					
P 206	0	0	0.0	$0	$0	$0.00	$0					
P 207	3	413	0.1	$31	$14	$16.34	$706	$351	$391	$45	$346	2.04
P 207A	0	0	0.0	$0	$0	$0.00	$0					
P 208	3	413	0.1	$31	$14	$16.34	$706	$351	$391	$45	$346	2.04
P 208A	0	0	0.0	$0	$0	$0.00	$0					
P 209	39	1,831	1.7	$137	$182	$72.40	$4,533	$4,563	$5,087	$585	$4,502	1.01
P 210	0	0	0.0	$0	$0	$0.00	$0					
P 211	0	0	0.0	$0	$0	$0.00	$0					
P 212	0	0	0.0	$0	$0	$0.00	$0					
P 219	0	0	0.0	$0	$0	$0.00	$0					
P 229	3	413	0.1	$31	$14	$16.34	$706	$351	$391	$45	$346	2.04
P 229A	0	0	0.0	$0	$0	$0.00	$0					
P 230	3	413	0.1	$31	$14	$16.34	$706	$351	$391	$45	$346	2.04
P 230A	0	0	0.0	$0	$0	$0.00	$0					
S 235	0	0	0.0	$0	$0	$0.00	$0					

ECO D4 SHEET 10 OF

ECO D-4A REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 60 W to 13W/5T4

Fac No.	A: I-60W Savings Energy Savings Fxtrs	kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 236	0	0	0.0	$0	$0	$0.00	$0					
S 237	0	0	0.0	$0	$0	$0.00	$0					
S 238	0	0	0.0	$0	$0	$0.00	$0					
P 240	0	0	0.0	$0	$0	$0.00	$0					
S 241	0	0	0.0	$0	$0	$0.00	$0					
S 243	0	0	0.0	$0	$0	$0.00	$0					
S 244	0	0	0.0	$0	$0	$0.00	$0					
S 246	0	0	0.0	$0	$0	$0.00	$0					
S 247	0	0	0.0	$0	$0	$0.00	$0					
P 252	1	89	0.0	$7	$5	$3.54	$172	$117	$130	$15	$115	1.49
P 256	0	0	0.0	$0	$0	$0.00	$0					
P 259	1	89	0.0	$7	$5	$3.54	$172	$117	$130	$15	$115	1.49
S 283	0	0	0.0	$0	$0	$0.00	$0					
S 286	0	0	0.0	$0	$0	$0.00	$0					
P 287	8	338	0.3	$25	$37	$13.37	$881	$936	$1,044	$120	$924	0.95
S 288	0	0	0.0	$0	$0	$0.00	$0					
S 290	0	0	0.0	$0	$0	$0.00	$0					
S 291	2	161	0.1	$12	$9	$6.36	$320	$234	$261	$30	$231	1.39
P 295	27	5,409	1.2	$403	$126	$213.86	$8,571	$3,159	$3,522	$405	$3,117	2.75
P 301	0	0	0.0	$0	$0	$0.00	$0					
P 642	0	0	0.0	$0	$0	$0.00	$0					
S 2201	0	0	0.0	$0	$0	$0.00	$0					
TOTALS	181	22,623	8	$1,686	$845	$894	$39,564	$21,175	$23,610	$2,715	$20,895	1.89

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

ECO D-4B REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 75 W to 18W/7T4

Fac No.	B: I-75W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
T 6	0	0	0.0	$0	$0	$0.00	$0					
P 41A	0	0	0.0	$0	$0	$0.00	$0					
P 41B	0	0	0.0	$0	$0	$0.00	$0					
P 42A	0	0	0.0	$0	$0	$0.00	$0					
P 42B	0	0	0.0	$0	$0	$0.00	$0					
P 43A	0	0	0.0	$0	$0	$0.00	$0					
P 43B	0	0	0.0	$0	$0	$0.00	$0					
P 44A	0	0	0.0	$0	$0	$0.00	$0					
P 44B	0	0	0.0	$0	$0	$0.00	$0					
P 45A	0	0	0.0	$0	$0	$0.00	$0					
P 45B	0	0	0.0	$0	$0	$0.00	$0					
P 46	0	0	0.0	$0	$0	$0.00	$0					
P 47	0	0	0.0	$0	$0	$0.00	$0					
P 51A	0	0	0.0	$0	$0	$0.00	$0					
P 51B	0	0	0.0	$0	$0	$0.00	$0					
P 52A	0	0	0.0	$0	$0	$0.00	$0					
P 52B	0	0	0.0	$0	$0	$0.00	$0					
P 53	0	0	0.0	$0	$0	$0.00	$0					
P 54	0	0	0.0	$0	$0	$0.00	$0					
P 55	0	0	0.0	$0	$0	$0.00	$0					
P 56	0	0	0.0	$0	$0	$0.00	$0					
P 57	0	0	0.0	$0	$0	$0.00	$0					
P 58	0	0	0.0	$0	$0	$0.00	$0					
P 59	0	0	0.0	$0	$0	$0.00	$0					
P 60	0	0	0.0	$0	$0	$0.00	$0					
S 79	0	0	0.0	$0	$0	$0.00	$0					
P 80	0	0	0.0	$0	$0	$0.00	$0					
P 81	12	98	0.6	$7	$65	$5.31	$907	$1,404	$1,565	$180	$1,385	0.65
P 101	0	0	0.0	$0	$0	$0.00	$0					
P 116	0	0	0.0	$0	$0	$0.00	$0					
T 120	0	0	0.0	$0	$0	$0.00	$0					
T 121	0	0	0.0	$0	$0	$0.00	$0					
T 124	0	0	0.0	$0	$0	$0.00	$0					
T 127	0	0	0.0	$0	$0	$0.00	$0					
P 128	0	0	0.0	$0	$0	$0.00	$0					
T 131	0	0	0.0	$0	$0	$0.00	$0					
S 144	0	0	0.0	$0	$0	$0.00	$0					

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ECO D-4B REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 75 W to 18W/7T4

Fac No.	B: I-75W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 146	0	0	0.0	$0	$0	$0.00	$0					
T 149	0	0	0.0	$0	$0	$0.00	$0					
T 156	0	0	0.0	$0	$0	$0.00	$0					
T 158	0	0	0.0	$0	$0	$0.00	$0					
T 161	0	0	0.0	$0	$0	$0.00	$0					
T 162	0	0	0.0	$0	$0	$0.00	$0					
T 163	0	0	0.0	$0	$0	$0.00	$0					
T 164	0	0	0.0	$0	$0	$0.00	$0					
T 165	0	0	0.0	$0	$0	$0.00	$0					
T 166	0	0	0.0	$0	$0	$0.00	$0					
T 167	0	0	0.0	$0	$0	$0.00	$0					
S 168	0	0	0.0	$0	$0	$0.00	$0					
T 172	0	0	0.0	$0	$0	$0.00	$0					
P 177	0	0	0.0	$0	$0	$0.00	$0					
P 178	0	0	0.0	$0	$0	$0.00	$0					
S 182	0	0	0.0	$0	$0	$0.00	$0					
S 186	0	0	0.0	$0	$0	$0.00	$0					
P 190	17	402	0.9	$30	$92	$21.72	$1,672	$1,989	$2,218	$255	$1,963	0.85
S 197	0	0	0.0	$0	$0	$0.00	$0					
S 198	0	0	0.0	$0	$0	$0.00	$0					
P 205	0	0	0.0	$0	$0	$0.00	$0					
P 205A	0	0	0.0	$0	$0	$0.00	$0					
P 206	0	0	0.0	$0	$0	$0.00	$0					
P 207	0	0	0.0	$0	$0	$0.00	$0					
P 207A	0	0	0.0	$0	$0	$0.00	$0					
P 208	0	0	0.0	$0	$0	$0.00	$0					
P 208A	0	0	0.0	$0	$0	$0.00	$0					
P 209	0	0	0.0	$0	$0	$0.00	$0					
P 210	0	0	0.0	$0	$0	$0.00	$0					
P 211	0	0	0.0	$0	$0	$0.00	$0					
P 212	0	0	0.0	$0	$0	$0.00	$0					
P 219	0	0	0.0	$0	$0	$0.00	$0					
P 229	0	0	0.0	$0	$0	$0.00	$0					
P 229A	0	0	0.0	$0	$0	$0.00	$0					
P 230	0	0	0.0	$0	$0	$0.00	$0					
P 230A	0	0	0.0	$0	$0	$0.00	$0					
S 235	0	0	0.0	$0	$0	$0.00	$0					

ECO D4 SHEET 13 OF 3·

ECO D-4B REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 75 W to 18W/7T4

Fac No.	B: I-75W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 236	0	0	0.0	$0	$0	$0.00	$0					
S 237	0	0	0.0	$0	$0	$0.00	$0					
S 238	0	0	0.0	$0	$0	$0.00	$0					
P 240	0	0	0.0	$0	$0	$0.00	$0					
S 241	0	0	0.0	$0	$0	$0.00	$0					
S 243	0	0	0.0	$0	$0	$0.00	$0					
S 244	0	0	0.0	$0	$0	$0.00	$0					
S 246	0	0	0.0	$0	$0	$0.00	$0					
S 247	0	0	0.0	$0	$0	$0.00	$0					
P 252	0	0	0.0	$0	$0	$0.00	$0					
P 256	2	208	0.1	$16	$11	$11.23	$433	$234	$261	$30	$231	1.88
P 259		0	0.0	$0	$0	$0.00	$0					
S 283	0	0	0.0	$0	$0	$0.00	$0					
S 286	0	0	0.0	$0	$0	$0.00	$0					
P 287	0	0	0.0	$0	$0	$0.00	$0					
S 288	0	0	0.0	$0	$0	$0.00	$0					
S 290	0	0	0.0	$0	$0	$0.00	$0					
S 291	0	0	0.0	$0	$0	$0.00	$0					
P 295	0	0	0.0	$0	$0	$0.00	$0					
P 301	0	0	0.0	$0	$0	$0.00	$0					
P 642	0	0	0.0	$0	$0	$0.00	$0					
S 2201	0	0	0.0	$0	$0	$0.00	$0					
TOTALS	2	208	0	$16	$11	$11	$433	$234	$261	$30	$231	1.88

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

ECO D-4C REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 100 W to 18W/7T4

Fac No.	C: I-100W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
T 6	2	131	0.2	$10	$16	$5.88	$370	$234	$261	$30	$231	1.60
P 41A	0	0	0.0	$0	$0	$0.00	$0					
P 41B	0	0	0.0	$0	$0	$0.00	$0					
P 42A	0	0	0.0	$0	$0	$0.00	$0					
P 42B	0	0	0.0	$0	$0	$0.00	$0					
P 43A	0	0	0.0	$0	$0	$0.00	$0					
P 43B	0	0	0.0	$0	$0	$0.00	$0					
P 44A	0	0	0.0	$0	$0	$0.00	$0					
P 44B	0	0	0.0	$0	$0	$0.00	$0					
P 45A	0	0	0.0	$0	$0	$0.00	$0					
P 45B	0	0	0.0	$0	$0	$0.00	$0					
P 46	0	0	0.0	$0	$0	$0.00	$0					
P 47	0	0	0.0	$0	$0	$0.00	$0					
P 51A	0	0	0.0	$0	$0	$0.00	$0					
P 51B	0	0	0.0	$0	$0	$0.00	$0					
P 52A	0	0	0.0	$0	$0	$0.00	$0					
P 52B	0	0	0.0	$0	$0	$0.00	$0					
P 53	0	0	0.0	$0	$0	$0.00	$0					
P 54	0	0	0.0	$0	$0	$0.00	$0					
P 55	0	0	0.0	$0	$0	$0.00	$0					
P 56	0	0	0.0	$0	$0	$0.00	$0					
P 57	0	0	0.0	$0	$0	$0.00	$0					
P 58	0	0	0.0	$0	$0	$0.00	$0					
P 59	0	0	0.0	$0	$0	$0.00	$0					
P 60	0	0	0.0	$0	$0	$0.00	$0					
S 79	0	0	0.0	$0	$0	$0.00	$0					
P 80	3	98	0.2	$7	$24	$4.41	$421	$351	$391	$45	$346	1.21
P 81	0	0	0.0	$0	$0	$0.00	$0					
P 101	0	0	0.0	$0	$0	$0.00	$0					
P 116	0	0	0.0	$0	$0	$0.00	$0					
T 120	1	349	0.1	$26	$8	$15.69	$574	$117	$130	$15	$115	4.98
T 121	1	218	0.1	$16	$8	$9.80	$395	$117	$130	$15	$115	3.42
T 124	0	0	0.0	$0	$0	$0.00	$0					
T 127	13	3,123	1.0	$233	$106	$140.19	$5,522	$1,521	$1,696	$195	$1,501	3.68
P 128	0	0	0.0	$0	$0	$0.00	$0					
T 131	0	0	0.0	$0	$0	$0.00	$0					
S 144	0	0	0.0	$0	$0	$0.00	$0					

ECO D4 SHEET 10 OF 5

ECO D-4C REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 100 W to 18W/7T4

Fac No.	C: I-100W Savings	Energy Savings				O&M	LCC Savings	Construction	Total Cost	Rebate	Investment	SIR
	Fxtrs	kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	$/Yr	$	$	$	$	$	
S 146	0	0	0.0	$0	$0	$0.00	$0					
T 149	1	66	0.1	$5	$8	$2.94	$185	$117	$130	$15	$115	1.60
T 156	0	0	0.0	$0	$0	$0.00	$0					
T 158	0	0	0.0	$0	$0	$0.00	$0					
T 161	0	0	0.0	$0	$0	$0.00	$0					
T 162	0	0	0.0	$0	$0	$0.00	$0					
T 163	0	0	0.0	$0	$0	$0.00	$0					
T 164	0	0	0.0	$0	$0	$0.00	$0					
T 165	0	0	0.0	$0	$0	$0.00	$0					
T 166	0	0	0.0	$0	$0	$0.00	$0					
T 167	0	0	0.0	$0	$0	$0.00	$0					
S 168	0	0	0.0	$0	$0	$0.00	$0					
T 172	0	0	0.0	$0	$0	$0.00	$0					
P 177	0	0	0.0	$0	$0	$0.00	$0					
P 178	0	0	0.0	$0	$0	$0.00	$0					
S 182	0	0	0.0	$0	$0	$0.00	$0					
S 186	0	0	0.0	$0	$0	$0.00	$0					
P 190	0	0	0.0	$0	$0	$0.00	$0					
S 197	0	0	0.0	$0	$0	$0.00	$0					
S 198	0	0	0.0	$0	$0	$0.00	$0					
P 205	0	0	0.0	$0	$0	$0.00	$0					
P 205A	0	0	0.0	$0	$0	$0.00	$0					
P 206	0	0	0.0	$0	$0	$0.00	$0					
P 207	0	0	0.0	$0	$0	$0.00	$0					
P 207A	0	0	0.0	$0	$0	$0.00	$0					
P 208	0	0	0.0	$0	$0	$0.00	$0					
P 208A	0	0	0.0	$0	$0	$0.00	$0					
P 209	0	0	0.0	$0	$0	$0.00	$0					
P 210	0	0	0.0	$0	$0	$0.00	$0					
P 211	0	0	0.0	$0	$0	$0.00	$0					
P 212	0	0	0.0	$0	$0	$0.00	$0					
P 219	0	0	0.0	$0	$0	$0.00	$0					
P 229	0	0	0.0	$0	$0	$0.00	$0					
P 229A	0	0	0.0	$0	$0	$0.00	$0					
P 230	0	0	0.0	$0	$0	$0.00	$0					
P 230A	0	0	0.0	$0	$0	$0.00	$0					
S 235	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4C REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 100 W to 18W/7T4

Fac No.	C: I-100W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 236	0	0	0.0	$0	$0	$0.00	$0					
S 237	0	0	0.0	$0	$0	$0.00	$0					
S 238	0	0	0.0	$0	$0	$0.00	$0					
P 240	0	0	0.0	$0	$0	$0.00	$0					
S 241	0	0	0.0	$0	$0	$0.00	$0					
S 243	0	0	0.0	$0	$0	$0.00	$0					
S 244	0	0	0.0	$0	$0	$0.00	$0					
S 246	0	0	0.0	$0	$0	$0.00	$0					
S 247	0	0	0.0	$0	$0	$0.00	$0					
P 252	0	0	0.0	$0	$0	$0.00	$0					
P 256	0	0	0.0	$0	$0	$0.00	$0					
P 259		0	0.0	$0	$0	$0.00	$0					
S 283	6	936	0.5	$70	$49	$42.02	$1,855	$702	$783	$90	$693	2.68
S 286	0	0	0.0	$0	$0	$0.00	$0					
P 287	0	0	0.0	$0	$0	$0.00	$0					
S 288	0	0	0.0	$0	$0	$0.00	$0					
S 290	0	0	0.0	$0	$0	$0.00	$0					
S 291	0	0	0.0	$0	$0	$0.00	$0					
P 295	0	0	0.0	$0	$0	$0.00	$0					
P 301	0	0	0.0	$0	$0	$0.00	$0					
P 642	0	0	0.0	$0	$0	$0.00	$0					
S 2201	0	0	0.0	$0	$0	$0.00	$0					
TOTALS	27	4,922	2	$367	$220	$221	$9,322	$3,159	$3,522	$405	$3,117	2.99

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

ECO D-4D REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 150 W to 26W/8T4

Fac No.	D: I-150W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
T 6	0	0	0.0	$0	$0	$0.00	$0					
P 41A	0	0	0.0	$0	$0	$0.00	$0					
P 41B	0	0	0.0	$0	$0	$0.00	$0					
P 42A	0	0	0.0	$0	$0	$0.00	$0					
P 42B	0	0	0.0	$0	$0	$0.00	$0					
P 43A	0	0	0.0	$0	$0	$0.00	$0					
P 43B	0	0	0.0	$0	$0	$0.00	$0					
P 44A	0	0	0.0	$0	$0	$0.00	$0					
P 44B	0	0	0.0	$0	$0	$0.00	$0					
P 45A	0	0	0.0	$0	$0	$0.00	$0					
P 45B	0	0	0.0	$0	$0	$0.00	$0					
P 46	0	0	0.0	$0	$0	$0.00	$0					
P 47	0	0	0.0	$0	$0	$0.00	$0					
P 51A	0	0	0.0	$0	$0	$0.00	$0					
P 51B	0	0	0.0	$0	$0	$0.00	$0					
P 52A	0	0	0.0	$0	$0	$0.00	$0					
P 52B	0	0	0.0	$0	$0	$0.00	$0					
P 53	0	0	0.0	$0	$0	$0.00	$0					
P 54	0	0	0.0	$0	$0	$0.00	$0					
P 55	0	0	0.0	$0	$0	$0.00	$0					
P 56	0	0	0.0	$0	$0	$0.00	$0					
P 57	0	0	0.0	$0	$0	$0.00	$0					
P 58	0	0	0.0	$0	$0	$0.00	$0					
P 59	0	0	0.0	$0	$0	$0.00	$0					
P 60	0	0	0.0	$0	$0	$0.00	$0					
S 79	0	0	0.0	$0	$0	$0.00	$0					
P 80	0	0	0.0	$0	$0	$0.00	$0					
P 81	0	0	0.0	$0	$0	$0.00	$0					
P 101	0	0	0.0	$0	$0	$0.00	$0					
P 116	0	0	0.0	$0	$0	$0.00	$0					
T 120	0	0	0.0	$0	$0	$0.00	$0					
T 121	0	0	0.0	$0	$0	$0.00	$0					
T 124	0	0	0.0	$0	$0	$0.00	$0					
T 127	0	0	0.0	$0	$0	$0.00	$0					
P 128	0	0	0.0	$0	$0	$0.00	$0					
T 131	0	0	0.0	$0	$0	$0.00	$0					
S 144	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4D REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 150 W to 26W/8T4

Fac No.	D: I-150W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 146	0	0	0.0	$0	$0	$0.00	$0					
T 149	0	0	0.0	$0	$0	$0.00	$0					
T 156	0	0	0.0	$0	$0	$0.00	$0					
T 158	3	0	0.3	$0	$37	$0.00	$431	$487	$543	$45	$498	0.87
T 161	0	0	0.0	$0	$0	$0.00	$0					
T 162	0	0	0.0	$0	$0	$0.00	$0					
T 163	0	0	0.0	$0	$0	$0.00	$0					
T 164	0	0	0.0	$0	$0	$0.00	$0					
T 165	0	0	0.0	$0	$0	$0.00	$0					
T 166	0	0	0.0	$0	$0	$0.00	$0					
T 167	0	0	0.0	$0	$0	$0.00	$0					
S 168	1	0	0.1	$0	$12	$0.00	$144	$162	$181	$15	$166	0.87
T 172	0	0	0.0	$0	$0	$0.00	$0					
P 177	0	0	0.0	$0	$0	$0.00	$0					
P 178	0	0	0.0	$0	$0	$0.00	$0					
S 182	0	0	0.0	$0	$0	$0.00	$0					
S 186	0	0	0.0	$0	$0	$0.00	$0					
P 190	0	0	0.0	$0	$0	$0.00	$0					
S 197	0	0	0.0	$0	$0	$0.00	$0					
S 198	0	0	0.0	$0	$0	$0.00	$0					
P 205	0	0	0.0	$0	$0	$0.00	$0					
P 205A	0	0	0.0	$0	$0	$0.00	$0					
P 206	0	0	0.0	$0	$0	$0.00	$0					
P 207	0	0	0.0	$0	$0	$0.00	$0					
P 207A	0	0	0.0	$0	$0	$0.00	$0					
P 208	0	0	0.0	$0	$0	$0.00	$0					
P 208A	0	0	0.0	$0	$0	$0.00	$0					
P 209	0	0	0.0	$0	$0	$0.00	$0					
P 210	0	0	0.0	$0	$0	$0.00	$0					
P 211	0	0	0.0	$0	$0	$0.00	$0					
P 212	0	0	0.0	$0	$0	$0.00	$0					
P 219	0	0	0.0	$0	$0	$0.00	$0					
P 229	0	0	0.0	$0	$0	$0.00	$0					
P 229A	0	0	0.0	$0	$0	$0.00	$0					
P 230	0	0	0.0	$0	$0	$0.00	$0					
P 230A	0	0	0.0	$0	$0	$0.00	$0					
S 235	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4D REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 150 W to 26W/8T4

Fac No.	D: I-150W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 236	0	0	0.0	$0	$0	$0.00	$0					
S 237	0	0	0.0	$0	$0	$0.00	$0					
S 238	31	7,286	3.5	$543	$380	$219.23	$13,243	$5,029	$5,607	$465	$5,142	2.58
P 240	0	0	0.0	$0	$0	$0.00	$0					
S 241	0	0	0.0	$0	$0	$0.00	$0					
S 243	0	0	0.0	$0	$0	$0.00	$0					
S 244	0	0	0.0	$0	$0	$0.00	$0					
S 246	0	0	0.0	$0	$0	$0.00	$0					
S 247	0	0	0.0	$0	$0	$0.00	$0					
P 252	0	0	0.0	$0	$0	$0.00	$0					
P 256	0	0	0.0	$0	$0	$0.00	$0					
P 259		0	0.0	$0	$0	$0.00	$0					
S 283	0	0	0.0	$0	$0	$0.00	$0					
S 286	0	0	0.0	$0	$0	$0.00	$0					
P 287	0	0	0.0	$0	$0	$0.00	$0					
S 288	0	0	0.0	$0	$0	$0.00	$0					
S 290	0	0	0.0	$0	$0	$0.00	$0					
S 291	0	0	0.0	$0	$0	$0.00	$0					
P 295	0	0	0.0	$0	$0	$0.00	$0					
P 301	0	0	0.0	$0	$0	$0.00	$0					
P 642	0	0	0.0	$0	$0	$0.00	$0					
S 2201	0	0	0.0	$0	$0	$0.00	$0					
TOTALS	31	7,286	4	$543	$380	$219	$13,243	$5,029	$5,607	$465	$5,142	2.58

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

ECO D-4E REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 250 W to 2 x F32/T8

Fac No.	E: I-250W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
T 6	0	0	0.0	$0	$0	$0.00	$0					
P 41A	0	0	0.0	$0	$0	$0.00	$0					
P 41B	0	0	0.0	$0	$0	$0.00	$0					
P 42A	0	0	0.0	$0	$0	$0.00	$0					
P 42B	0	0	0.0	$0	$0	$0.00	$0					
P 43A	0	0	0.0	$0	$0	$0.00	$0					
P 43B	0	0	0.0	$0	$0	$0.00	$0					
P 44A	0	0	0.0	$0	$0	$0.00	$0					
P 44B	0	0	0.0	$0	$0	$0.00	$0					
P 45A	0	0	0.0	$0	$0	$0.00	$0					
P 45B	0	0	0.0	$0	$0	$0.00	$0					
P 46	0	0	0.0	$0	$0	$0.00	$0					
P 47	0	0	0.0	$0	$0	$0.00	$0					
P 51A	0	0	0.0	$0	$0	$0.00	$0					
P 51B	0	0	0.0	$0	$0	$0.00	$0					
P 52A	0	0	0.0	$0	$0	$0.00	$0					
P 52B	0	0	0.0	$0	$0	$0.00	$0					
P 53	0	0	0.0	$0	$0	$0.00	$0					
P 54	0	0	0.0	$0	$0	$0.00	$0					
P 55	0	0	0.0	$0	$0	$0.00	$0					
P 56	0	0	0.0	$0	$0	$0.00	$0					
P 57	0	0	0.0	$0	$0	$0.00	$0					
P 58	0	0	0.0	$0	$0	$0.00	$0					
P 59	0	0	0.0	$0	$0	$0.00	$0					
P 60	0	0	0.0	$0	$0	$0.00	$0					
S 79	0	0	0.0	$0	$0	$0.00	$0					
P 80	0	0	0.0	$0	$0	$0.00	$0					
P 81	0	0	0.0	$0	$0	$0.00	$0					
P 101	0	0	0.0	$0	$0	$0.00	$0					
P 116	0	0	0.0	$0	$0	$0.00	$0					
T 120	0	0	0.0	$0	$0	$0.00	$0					
T 121	0	0	0.0	$0	$0	$0.00	$0					
T 124	0	0	0.0	$0	$0	$0.00	$0					
T 127	0	0	0.0	$0	$0	$0.00	$0					
P 128	0	0	0.0	$0	$0	$0.00	$0					
T 131	0	0	0.0	$0	$0	$0.00	$0					
S 144	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4E REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 250 W to 2 x F32/T8

Fac No.	E: I-250W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 146	0	0	0.0	$0	$0	$0.00	$0					
T 149	0	0	0.0	$0	$0	$0.00	$0					
T 156	0	0	0.0	$0	$0	$0.00	$0					
T 158	0	0	0.0	$0	$0	$0.00	$0					
T 161	0	0	0.0	$0	$0	$0.00	$0					
T 162	0	0	0.0	$0	$0	$0.00	$0					
T 163	0	0	0.0	$0	$0	$0.00	$0					
T 164	0	0	0.0	$0	$0	$0.00	$0					
T 165	0	0	0.0	$0	$0	$0.00	$0					
T 166	0	0	0.0	$0	$0	$0.00	$0					
T 167	0	0	0.0	$0	$0	$0.00	$0					
S 168	0	0	0.0	$0	$0	$0.00	$0					
T 172	0	0	0.0	$0	$0	$0.00	$0					
P 177	0	0	0.0	$0	$0	$0.00	$0					
P 178	0	0	0.0	$0	$0	$0.00	$0					
S 182	0	0	0.0	$0	$0	$0.00	$0					
S 186	0	0	0.0	$0	$0	$0.00	$0					
P 190	0	0	0.0	$0	$0	$0.00	$0					
S 197	0	0	0.0	$0	$0	$0.00	$0					
S 198	0	0	0.0	$0	$0	$0.00	$0					
P 205	0	0	0.0	$0	$0	$0.00	$0					
P 205A	0	0	0.0	$0	$0	$0.00	$0					
P 206	0	0	0.0	$0	$0	$0.00	$0					
P 207	0	0	0.0	$0	$0	$0.00	$0					
P 207A	0	0	0.0	$0	$0	$0.00	$0					
P 208	0	0	0.0	$0	$0	$0.00	$0					
P 208A	0	0	0.0	$0	$0	$0.00	$0					
P 209	0	0	0.0	$0	$0	$0.00	$0					
P 210	0	0	0.0	$0	$0	$0.00	$0					
P 211	0	0	0.0	$0	$0	$0.00	$0					
P 212	0	0	0.0	$0	$0	$0.00	$0					
P 219	0	0	0.0	$0	$0	$0.00	$0					
P 229	0	0	0.0	$0	$0	$0.00	$0					
P 229A	0	0	0.0	$0	$0	$0.00	$0					
P 230	0	0	0.0	$0	$0	$0.00	$0					
P 230A	0	0	0.0	$0	$0	$0.00	$0					
S 235	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4E REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 250 W to 2 x F32/T8

Fac No.	E: I-250W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 236	0	0	0.0	$0	$0	$0.00	$0					
S 237	0	0	0.0	$0	$0	$0.00	$0					
S 238	0	0	0.0	$0	$0	$0.00	$0					
P 240	0	0	0.0	$0	$0	$0.00	$0					
S 241	0	0	0.0	$0	$0	$0.00	$0					
S 243	0	0	0.0	$0	$0	$0.00	$0					
S 244	0	0	0.0	$0	$0	$0.00	$0					
S 246	0	0	0.0	$0	$0	$0.00	$0					
S 247	0	0	0.0	$0	$0	$0.00	$0					
P 252	9	3,538	1.7	$264	$185	$93.72	$6,289	$1,755	$1,957	$225	$1,732	3.63
P 256	1	393	0.2	$29	$21	$10.41	$699	$195	$217	$25	$192	3.63
P 259	10	3,931	1.9	$293	$205	$104.14	$6,988	$1,950	$2,174	$250	$1,924	3.63
S 283	0	0	0.0	$0	$0	$0.00	$0					
S 286	0	0	0.0	$0	$0	$0.00	$0					
P 287	0	0	0.0	$0	$0	$0.00	$0					
S 288	0	0	0.0	$0	$0	$0.00	$0					
S 290	0	0	0.0	$0	$0	$0.00	$0					
S 291	0	0	0.0	$0	$0	$0.00	$0					
P 295	0	0	0.0	$0	$0	$0.00	$0					
P 301	0	0	0.0	$0	$0	$0.00	$0					
P 642	0	0	0.0	$0	$0	$0.00	$0					
S 2201	0	0	0.0	$0	$0	$0.00	$0					
TOTALS	20	7,862	4	$586	$411	$208	$13,976	$3,900	$4,348	$500	$3,848	3.63

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

ECO D-4F REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 300 W to 2 x F32/T8

Fac No.	F: I-300W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
T 6	0	0	0.0	$0	$0	$0.00	$0					
P 41A	0	0	0.0	$0	$0	$0.00	$0					
P 41B	0	0	0.0	$0	$0	$0.00	$0					
P 42A	0	0	0.0	$0	$0	$0.00	$0					
P 42B	0	0	0.0	$0	$0	$0.00	$0					
P 43A	0	0	0.0	$0	$0	$0.00	$0					
P 43B	0	0	0.0	$0	$0	$0.00	$0					
P 44A	0	0	0.0	$0	$0	$0.00	$0					
P 44B	0	0	0.0	$0	$0	$0.00	$0					
P 45A	0	0	0.0	$0	$0	$0.00	$0					
P 45B	0	0	0.0	$0	$0	$0.00	$0					
P 46	0	0	0.0	$0	$0	$0.00	$0					
P 47	0	0	0.0	$0	$0	$0.00	$0					
P 51A	0	0	0.0	$0	$0	$0.00	$0					
P 51B	0	0	0.0	$0	$0	$0.00	$0					
P 52A	0	0	0.0	$0	$0	$0.00	$0					
P 52B	0	0	0.0	$0	$0	$0.00	$0					
P 53	0	0	0.0	$0	$0	$0.00	$0					
P 54	0	0	0.0	$0	$0	$0.00	$0					
P 55	0	0	0.0	$0	$0	$0.00	$0					
P 56	0	0	0.0	$0	$0	$0.00	$0					
P 57	0	0	0.0	$0	$0	$0.00	$0					
P 58	0	0	0.0	$0	$0	$0.00	$0					
P 59	0	0	0.0	$0	$0	$0.00	$0					
P 60	0	0	0.0	$0	$0	$0.00	$0					
S 79	0	0	0.0	$0	$0	$0.00	$0					
P 80	0	0	0.0	$0	$0	$0.00	$0					
P 81	20	783	4.8	$58	$519	$23.83	$7,021	$3,900	$4,348	$500	$3,848	1.82
P 101	0	0	0.0	$0	$0	$0.00	$0					
P 116	0	0	0.0	$0	$0	$0.00	$0					
T 120	3	3,341	0.7	$249	$78	$101.66	$4,955	$585	$652	$75	$577	8.58
T 121	0	0	0.0	$0	$0	$0.00	$0					
T 124	0	0	0.0	$0	$0	$0.00	$0					
T 127	0	0	0.0	$0	$0	$0.00	$0					
P 128	0	0	0.0	$0	$0	$0.00	$0					
T 131	0	0	0.0	$0	$0	$0.00	$0					
S 144	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4F REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 300 W to 2 x F32/T8

Fac No.	F: I-300W Savings Fxtrs	Energy Savings kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	O&M $/Yr	LCC Savings $	Construction $	Total Cost $	Rebate $	Investment $	SIR
S 146	0	0	0.0	$0	$0	$0.00	$0					
T 149	0	0	0.0	$0	$0	$0.00	$0					
T 156	0	0	0.0	$0	$0	$0.00	$0					
T 158	0	0	0.0	$0	$0	$0.00	$0					
T 161	0	0	0.0	$0	$0	$0.00	$0					
T 162	0	0	0.0	$0	$0	$0.00	$0					
T 163	0	0	0.0	$0	$0	$0.00	$0					
T 164	0	0	0.0	$0	$0	$0.00	$0					
T 165	0	0	0.0	$0	$0	$0.00	$0					
T 166	0	0	0.0	$0	$0	$0.00	$0					
T 167	0	0	0.0	$0	$0	$0.00	$0					
S 168	0	0	0.0	$0	$0	$0.00	$0					
T 172	0	0	0.0	$0	$0	$0.00	$0					
P 177	0	0	0.0	$0	$0	$0.00	$0					
P 178	0	0	0.0	$0	$0	$0.00	$0					
S 182	0	0	0.0	$0	$0	$0.00	$0					
S 186	0	0	0.0	$0	$0	$0.00	$0					
P 190	0	0	0.0	$0	$0	$0.00	$0					
S 197	0	0	0.0	$0	$0	$0.00	$0					
S 198	0	0	0.0	$0	$0	$0.00	$0					
P 205	0	0	0.0	$0	$0	$0.00	$0					
P 205A	0	0	0.0	$0	$0	$0.00	$0					
P 206	0	0	0.0	$0	$0	$0.00	$0					
P 207	0	0	0.0	$0	$0	$0.00	$0					
P 207A	0	0	0.0	$0	$0	$0.00	$0					
P 208	0	0	0.0	$0	$0	$0.00	$0					
P 208A	0	0	0.0	$0	$0	$0.00	$0					
P 209	0	0	0.0	$0	$0	$0.00	$0					
P 210	0	0	0.0	$0	$0	$0.00	$0					
P 211	0	0	0.0	$0	$0	$0.00	$0					
P 212	0	0	0.0	$0	$0	$0.00	$0					
P 219	0	0	0.0	$0	$0	$0.00	$0					
P 229	0	0	0.0	$0	$0	$0.00	$0					
P 229A	0	0	0.0	$0	$0	$0.00	$0					
P 230	0	0	0.0	$0	$0	$0.00	$0					
P 230A	0	0	0.0	$0	$0	$0.00	$0					
S 235	0	0	0.0	$0	$0	$0.00	$0					

ECO D-4F REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: I 300 W to 2 x F32/T8

Fac No.	F: I-300W Savings	Energy Savings				O&M	LCC Savings	Construction	Total Cost	Rebate	Investment	SIR
	Fxtrs	kWH/Yr	kW Demand	Use $/Yr	Demand $/Yr	$/Yr	$	$	$	$	$	
S 236	0	0	0.0	$0	$0	$0.00	$0					
S 237	0	0	0.0	$0	$0	$0.00	$0					
S 238	0	0	0.0	$0	$0	$0.00	$0					
P 240	0	0	0.0	$0	$0	$0.00	$0					
S 241	0	0	0.0	$0	$0	$0.00	$0					
S 243	0	0	0.0	$0	$0	$0.00	$0					
S 244	0	0	0.0	$0	$0	$0.00	$0					
S 246	0	0	0.0	$0	$0	$0.00	$0					
S 247	0	0	0.0	$0	$0	$0.00	$0					
P 252	0	0	0.0	$0	$0	$0.00	$0					
P 256	0	0	0.0	$0	$0	$0.00	$0					
P 259	0	0	0.0	$0	$0	$0.00	$0					
S 283	0	0	0.0	$0	$0	$0.00	$0					
S 286	0	0	0.0	$0	$0	$0.00	$0					
P 287	0	0	0.0	$0	$0	$0.00	$0					
S 288	0	0	0.0	$0	$0	$0.00	$0					
S 290	0	0	0.0	$0	$0	$0.00	$0					
S 291	0	0	0.0	$0	$0	$0.00	$0					
P 295	0	0	0.0	$0	$0	$0.00	$0					
P 301	0	0	0.0	$0	$0	$0.00	$0					
P 642	0	0	0.0	$0	$0	$0.00	$0					
S 2201	0	0	0.0	$0	$0	$0.00	$0					
TOTALS	23	4,124	5	$307	$597	$125	$11,976	$4,485	$5,000	$575	$4,425	2.71

TOTALS ONLY FOR BUILDINGS WITH SIR's OVER 1.0

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO D4
Sheet 26 of 35

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent — Fiscal Year FY96
Discrete Portion Name: A. I60W to 13W/5T4
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$21,175		
B. SIOH	$1,165		
C. Design Cost	$1,270		
D. Total Cost (1A+1B+1C)	$23,610		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($2,715)	
G. Total Investment (1D-1E-1F)			$20,895

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	77.2	$1,686	11.70	$19,729
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	7.8 kW	$845	11.70	$9,889
E. Other					
F. Total			$2,532		$29,619

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$894		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$9,945

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $9,945

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	6.1	Years
5. Total Net Discounted Savings (2F5+3C):	$39,564	
6. Savings to Investment Ratio (SIR) 5/1G:	1.89	
7. Adjusted Internal Rate of Return (AIRR):	8.52%	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO D4
Sheet 37 of 35

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent
Fiscal Year FY96
Discrete Portion Name: B. I75W to 18W/7T4
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$234		
B. SIOH	$13		
C. Design Cost	$14		
D. Total Cost (1A+1B+1C)	$261		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($30)	
G. Total Investment (1D-1E-1F)			$231

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	0.7		$16	11.70	$181
B. Dist	$4.98	0.0		$0	13.78	$0
C. Propane	$7.87	0.0		$0	14.16	$0
D. Demand	$108.60	0.1	kW	$11	11.70	$127
E. Other						
F. Total				$26		$308

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$11		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$125

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $125

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	6.1	Years
5. Total Net Discounted Savings (2F5+3C):	$433	
6. Savings to Investment Ratio (SIR) 5/1G:	1.88	
7. Adjusted Internal Rate of Return (AIRR):	8.46%	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO D4
Sheet 28 of 35

Location: Fort Hunter Liggett, California — Region No. 4 — Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent — Fiscal Year FY96
Discrete Portion Name: C. I100W to 18W/7T4
Analysis Date: March 1993 — Economic Life: 15 YEARS — Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$3,159		
B. SIOH	$174		
C. Design Cost	$190		
D. Total Cost (1A+1B+1C)	$3,522		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($405)	
G. Total Investment (1D-1E-1F)			$3,117

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	16.8		$367	11.70	$4,292
B. Dist	$4.98	0.0		$0	13.78	$0
C. Propane	$7.87	0.0		$0	14.16	$0
D. Demand	$108.60	2.0	kW	$220	11.70	$2,573
E. Other						
F. Total				$587		$6,865

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$221		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$2,457

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $2,457

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 3.9 Years
5. Total Net Discounted Savings (2F5+3C): $9,322
6. Savings to Investment Ratio (SIR) 5/1G: 2.99
7. Adjusted Internal Rate of Return (AIRR): 11.88%

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO D4
Sheet 29 of 35

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent
Fiscal Year FY96
Discrete Portion Name: D. I150W to 26W/8T4
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$5,029		
B. SIOH	$277		
C. Design Cost	$302		
D. Total Cost (1A+1B+1C)	$5,607		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($465)	
G. Total Investment (1D-1E-1F)			$5,142

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	24.9	$543	11.70	$6,354
B. Dist	$4.98	0.0	$0	13.78	$0
C. Propane	$7.87	0.0	$0	14.16	$0
D. Demand	$108.60	3.5 kW	$380	11.70	$4,451
E. Other					
F. Total			$924		$10,805

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$219		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$2,438

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $2,438

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	4.5 Years
5. Total Net Discounted Savings (2F5+3C):	$13,243
6. Savings to Investment Ratio (SIR) 5/1G:	2.58
7. Adjusted Internal Rate of Return (AIRR):	10.77%

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO D4
Sheet 30 of 35

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent
Fiscal Year FY96
Discrete Portion Name: E. 1250W to 2-F32/T8
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$3,900		
B. SIOH	$214		
C. Design Cost	$234		
D. Total Cost (1A+1B+1C)	$4,348		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($500)	
G. Total Investment (1D-1E-1F)			$3,848

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	26.8		$586	11.70	$6,857
B. Dist	$4.98	0.0		$0	13.78	$0
C. Propane	$7.87	0.0		$0	14.16	$0
D. Demand	$108.60	3.8	kW	$411	11.70	$4,803
E. Other						
F. Total				$997		$11,660

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$208		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$2,316

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $2,316

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 3.2 Years
5. Total Net Discounted Savings (2F5+3C): $13,976
6. Savings to Investment Ratio (SIR) 5/1G: 3.63
7. Adjusted Internal Rate of Return (AIRR): 13.34%

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Hunter Liggett, California
Region No. 4
Project No. 16-403-10
Project Title: LIGHTING - Incandescent to Fluorescent
Fiscal Year FY96
Discrete Portion Name: F. I300W to 2-F32/T8
Analysis Date: March 1993
Economic Life: 15 YEARS
Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$4,485		
B. SIOH	$247		
C. Design Cost	$269		
D. Total Cost (1A+1B+1C)	$5,000		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($575)	
G. Total Investment (1D-1E-1F)			$4,425

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	14.1		$307	11.70	$3,596
B. Dist	$4.98	0.0		$0	13.78	$0
C. Propane	$7.87	0.0		$0	14.16	$0
D. Demand	$108.60	5.5	kW	$597	11.70	$6,985
E. Other						
F. Total				$904		$10,581

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$125		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			$1,395

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

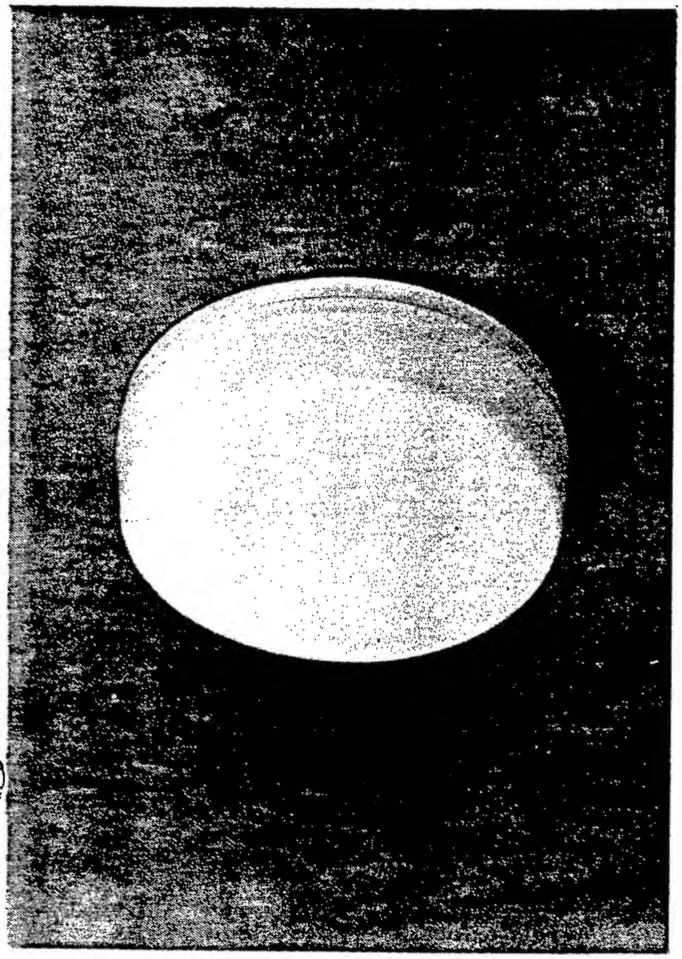
C Total Non Energy Discounted Savings (3A2+3Bd4) $1,395

4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 4.3 Years
5. Total Net Discounted Savings (2F5+3C): $11,976
6. Savings to Investment Ratio (SIR) 5/1G: 2.71
7. Adjusted Internal Rate of Return (AIRR): 11.14%

Heavy Duty Unbreakable Vandal Resistant Lens

ECO D4 SHEET 32 OF 35
RETROFITS A, B AND C

Energy Saving, Indoor or Outdoor
Cut Lighting Cost Up to 80%



7, 9, 13 or 26 Watt Vandal Resistant Fluorescent Wall or Ceiling

As rugged as it is stylish, this vandal resistant wall or ceiling fixture is the ideal choice for doorway and corridor lighting where style and durability is required.

Housing: Spun steel, painted with electrostatically applied white polyester powder coating.

Diffuser: UV stabilized, injection molded white Acrylic DR.

Ballast: Preheat NPF, 118 volt, engineered specifically for the designated lamp, 7, 9, or 13 watt, 20, 22 watt circline.

Marking: U.L. listed and labeled, damp location standard, use indoor or outdoor.

Annual Energy Savings When Replacing Incandescent

Fluorescent Lamp	Equivalent Incandescent	Dollar Savings per KWH 6¢	8¢	10¢
7 watt	40 watt	16.29	21.72	27.16
9 watt	60 watt	25.75	39.94	49.92
13 watt	75 watt	31.01	41.35	51.68

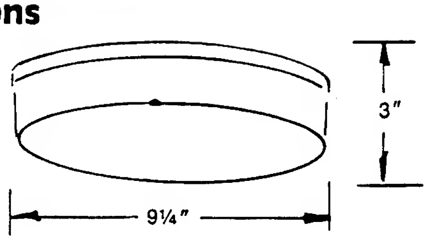
Note: Based on burning 24 hours per day. Equivalent incandescent wattages are approximates, and are based on replacing standard A-Line incandescent lamps. Wattage comparison may vary with application.

Footcandle Measurements

Based on single wall mounted fixture • 6′ wide corridor
8′ ceiling height • 6′ mounting height • 80% ceiling reflectance
50% wall reflectance • 20% floor reflectance.

Catalog number	Distance from fixture along the wall 0′	2′	4′	6′	8′	10′	12′	14′	16′

Specifications



Ordering Information/Operating Characteristics

Catalog number	Lamp Type	Initial Lumens	Approximate Incandescent Equivalent	Lamp* Life hours	Input Volts	Input Watts	Input Amps Starting	Input Amps Operating	Minimum starting Temp.
1401-7	PL-7	400	40	10,000	118	9	.240	.180	0°F
1401-9	PL-9	600	60	10,000	118	11	.240	.180	25°F
1401-13	PL-13	900	75	10,000	118	15	.350	.250	32°F
1401-2X13	PL-13	1800	100	10,000	18	30	.700	.500	32°F

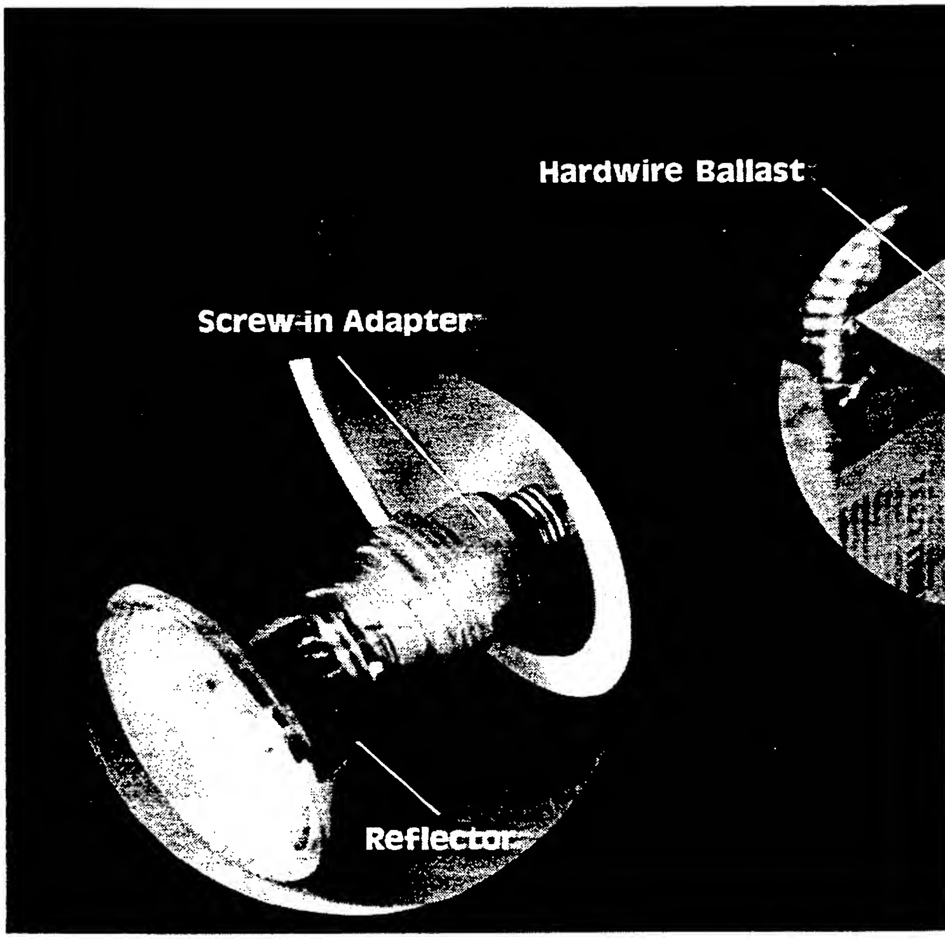
*Based on 3 hr burn-longer burning cycle will result in proportionally longer life.

JANMAR Lighting 3700 Eagle Rock Blvd., Los Angeles, CA 90065 • 213/254-7501 FAX 213/254-7640

ECO D4 SHEET 33 OF 35
RETROFIT D

The Ultimate Fluorescent Retrofit! From Janmar

Convert Virtually Any Recessed Fixture, Incandescent, Mercury Vapor, 120 Volt, 277 Volt, Medium or Mogul Base

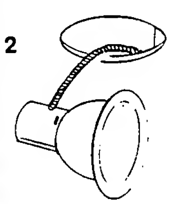


Patent Pending

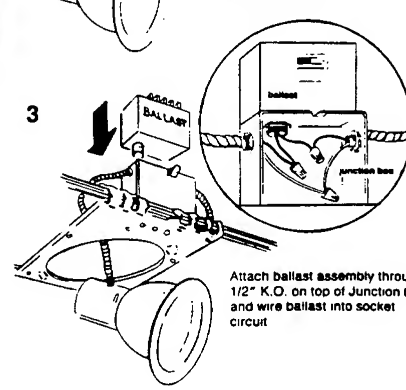
Easy Retrofit Installation

1

Existing down light

2

Remove reflector to access J-box

To access junction box, in plaster ceiling, remove reflector assembly. In dropped T-bar ceiling, the removal of an adjacent ceiling tile will allow access to the J-box.

3


Attach ballast assembly through 1/2" K.O. on top of Junction box and wire ballast into socket circuit

4

Screw in adapter-reflector assembly to complete assembly

Patent Pending
UL Pending

You Make The Choice!

At last you can select the length, the wattage and reflector to exactly fit your lighting requirements.

Convert those, energy robbing, Incandescent or Mercury Vapor recessed fixtures to energy efficient Flourescent, quickly and easily. No need to remove existing socket. Simply wire in ballast assembly to the top of junction box, and screw in adapter-reflector assembly.

Check These Options!

Ballast • 120 Volt, 277 Volt
• High Power Factor
• Class P (Thermal Protection)

Lamps • 5, 7, 9 or 13 Watt Twin Tube
• 13 Watt Quad Double Twin Tube
• 28 Watt Quad Double Twin Tube

Length • 3 Optional Adapter Lengths for Various Depth Fixtures.

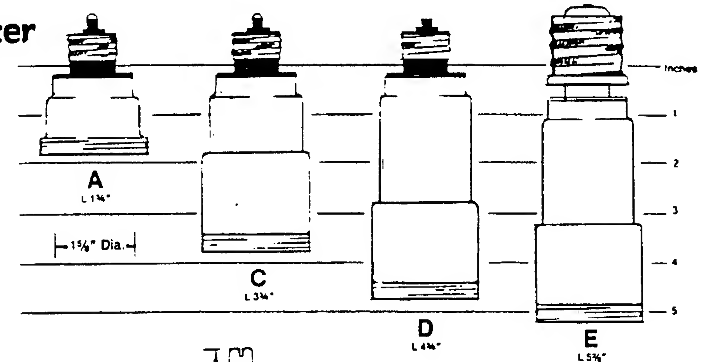
Base • Medium Edison Standard
Mogul Base Optional

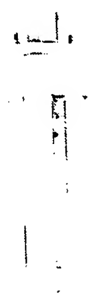
213 Series The Ultimate Fluorescent Retrofit!

Medium Base Adaptor Assembly

Select an Adapter

Threaded aluminum adapter with a turning diameter of only 1⅝", and four optional lengths to choose from, insures an exact fit into almost any fixture, shallow or deep.

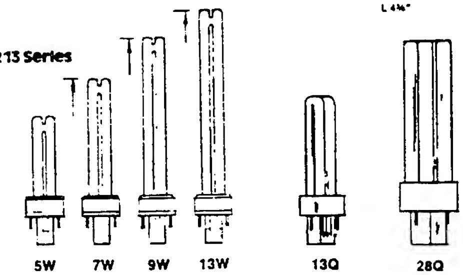




PL Lamp

Select a Lamp

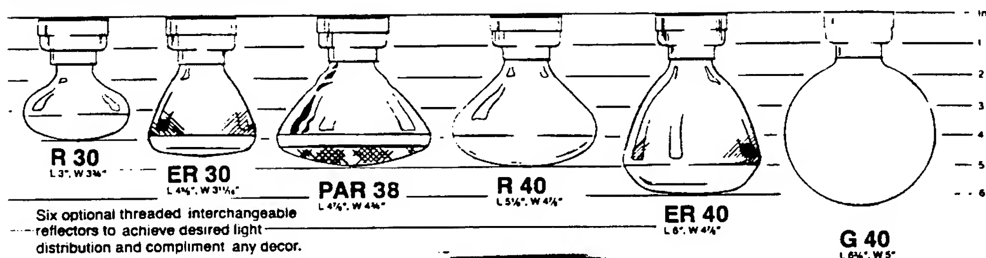
Nine optional lamp wattages insures desired level of illumination.



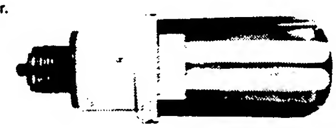
Mogul Base optional on all units, use order suffix MB. add ⅝" to overall length.

Aluminized Glass Reflector

Select a Reflector

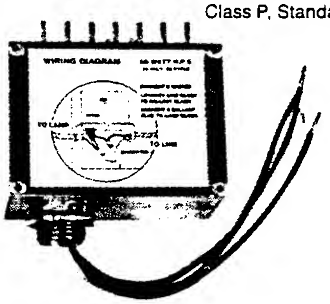


Six optional threaded interchangeable reflectors to achieve desired light distribution and compliment any decor.



Reflector available on all 213 Series

Ordering Information / Operating Characteristics
213 Series



Aluminum Ballast Housing Type 1 Potted Ballast Class P, Standard

Model No. & Option Suffix	Flourescent Lamps Watts and Initial Lumens	Incandescent replacement	Optional reflectors	Optional Screw-in Socket Installed Length A	C	D	E	Maximum Foot-Candles at 8'
Single Twin Lamps				A	C	D	E	
213-5A-R30	5 Watt Twin Tube 250 Lumens	25 to 40 Watts 200 to 350 Lumens	R 30	4¾"	5¾"	6¾"	7¾"	2.3
213-5A-ER30			ER 30	5¾"	6¾"	7¾"	8¾"	2.3
213-5A-R40			R 40	6½"	7½"	8½"	9½"	3.9
213-5A-PAR 38			PAR 38	6¼"	7¼"	8¼"	9¼"	4.3
213-5A-G40			G 40	7¾"	8¾"	9¾"	10¾"	.8
213-7A-ER30	7 Watt Twin Tube 400 Lumens	40 to 75 Watts 350 to 765 Lumens	ER 30	5¾"	6¾"	7¾"	8¾"	2.5
213-7A-R40			R 40	6½"	7½"	8½"	9½"	2.3
213-7A-PAR 38			PAR 38	6¼"	7¼"	8¼"	9¼"	4.0
213-7A-G40			G 40	7¾"	8¾"	9¾"	10¾"	1.1
213-9A-ER40	9 Watt Twin Tube 600 Lumens	50 to 100 Watts 425 to 1200 Lumens	ER 40	7½"	8½"	9½"	10½"	4.3
213-9A-G40			G 40	7¾"	8¾"	9¾"	10¾"	1.7
10mm Quad Double Twin Lamps				A	C	D	E	
213-13Q-A-ER30	13 Watt Quad Double Twin Tube 900 Lumens	75 to 150 Watts 765 to 1740 Lumens	ER 30	5¾"	6¾"	7¾"	8¾"	3.3
213-13Q-A-R40			R 40	6½"	7½"	8½"	9½"	6.9
213-13Q-A-PAR 38			PAR 38	6¼"	7¼"	8¼"	9¼"	7.2
213-13Q-A-G40			G 40	7¾"	8¾"	9¾"	10¾"	1.6
15mm Quad Double Twin Lamps				A	C	D	E	
213-28Q-A	28 Watt Quad Double Twin Tube 1600 Lumens	150 to 200 Watts 1740 to 2000 Lumens	R 60	9	10	11	12	12.4

Options:

- 277 — 277 Volt (120 Volt Standard)
- HP — High Power Factor
- MB — Mogul Base
- REF — Reflector
- SE — Edison Socket Extender
- MBE — Mogul Base Socket Extender

T8 Straight Lamps

FBO T8
U-Shaped Lamps

T-8 RAPID START

ADVANCE BALLASTS

ECO D4 SHEET 35 OF 35

One Lamp—High Power Factor

Lamp Data: Description	Watts	Circuit (Volts)	Min. Starting Temp. (°F.)	Catalog Number (All Class P)†	Notes	Line Current (Amps)	Input ANSI (Watts)	Sound Rating	Dimensions (Page 22)	Wiring Diagram No. (Page 24)	Shipping Data: Units Std. Ctn.	Weight Std. Ctn. (Lbs.)
(1) FBO16T8, (1) F17T8, (1) FO17T8	16 17 17	120	50	R-1P817-TP		.195	23	A	T-2	20	10	38
		277	50	V-1P817-TP		.085	23					
(1) FBO24T8, (1) F25T8, (1) FO25T8	24 25 25	120	50	R-1P825-TP	2	.30	33	A	T-2	20	10	38
		277	50	V-1P825-TP		.12	33					
(1) FBO31T8, (1) F32T8, (1) FO32T8	31 32 32	120	50 50 50 50	R-1P32-TP REL-3P32-TP (Electronic) RIC-140-TP (Electronic IC) RIC-132-TP (Electronic IC)	1,2 50 2,5 5	.32 .34 .35 .27	37 37 40 31	A	T-2	20 93 20 20	10	37 26 15 15
		277	50 50 50 50	V-1P32-TP VEL-3P32-TP (Electronic) VIC-140-TP (Electronic IC) VIC-132-TP (Electronic IC)	1,2 50 5 5	.14 .15 .15 .12	37 37 40 31	A	T-2	20 93 20 20	10	37 26 15 15
(1) F40T8, (1) FO40T8	40	120	50	R-1P840-TP	2	.44	50	A	T-2	20	10	38
		277	50	V-1P840-TP		.19	50	A	T-2	20	10	38

Two Lamps—High Power Factor

RETROFIT E AND F

Lamp Data: Description	Watts	Circuit (Volts)	Min. Starting Temp. (°F.)	Catalog Number (All Class P)†	Notes	Line Current (Amps)	Input ANSI (Watts)	Sound Rating	Dimensions (Page 22)	Wiring Diagram No. (Page 24)	Shipping Data: Units Std. Ctn.	Weight Std. Ctn. (Lbs.)
(2) FBO16T8, (2) F17T8, (2) FO17T8	16 17 17	120	50	R-2P817-TP		.39	45	A	T-2	21	10	38
		277	50	V-2P817-TP		.163	45	A	T-2	21	10	38
(2) FBO24T8, (2) F25T8, (2) FO25T8	24 25 25	120	50	R-2P825-TP	2	.55	65	A	T-2	21	10	38
		277	50	V-2P825-TP		.24	65	A	T-2	21	10	38
(2) FBO31T8, (2) F32T8, (2) FO32T8	31 32 32	120	50 50 50 50	R-2P32-TP REL-3P32-TP (Electronic) ~~RIC-2S40-TP (Electronic IC)~~ RIC-2S32-TP (Electronic IC)	1,2 2,40,50 ~~2,5,49~~ 5,49	.61 .57 ~~.65~~ .52	71 64 ~~77~~ 61	A	T-2	21 93 21 21	10	37 26 15 15
		277	50 50 50 50	V-2P32-TP VEL-3P32-TP (Electronic) VIC-2S40-TP (Electronic IC) VIC-2S32-TP (Electronic IC)	1,2 2,40,50 2,5,49 5,49	.26 .24 .27 .22	71 63 73 60	A	T-2	21 93 21 21	10	37 26 15 15
(2) F40T8, (2) FO40T8	40	120	50	R-2P840-TP	2	.77	92	A	T-2	21	10	38
		277	50	V-2P840-TP		.34	92	A	T-2	21	10	38

Three Lamps—High Power Factor

Lamp Data: Description	Watts	Circuit (Volts)	Min. Starting Temp. (°F.)	Catalog Number (All Class P)†	Notes	Line Current (Amps)	Input ANSI (Watts)	Sound Rating	Dimensions (Page 22)	Wiring Diagram No. (Page 24)	Shipping Data: Units Std. Ctn.	Weight Std. Ctn. (Lbs.)
(3) FBO16T8, (3) F17T8, (3) FO17T8	16 17 17	120	50	REL-3P32-TP (Electronic) REL-4P32-TP (Electronic)	50 50	.45 .46	51 53	A	T-2	93 97	10	26 25
		277	50	VEL-3P32-TP (Electronic) VEL-4P32-TP (Electronic)	50 50	.18 .20	46 51	A		93 97		26 25
(3) FBO24T8, (3) F25T8, (3) FO25T8	24 25 25	120	50	REL-3P32-TP (Electronic) RIC-3S32-TP (Electronic IC)	50 5	.61 .58	70 68	A	T-2	93	10	26 25
		277	50	VEL-3P32-TP (Electronic) VIC-3S32-TP (Electronic IC)	50 5	.25 .25	65 66	A				26 25
(3) FBO31T8, (3) F32T8, (3) FO32T8	31 32 32	120	50	REL-3P32-TP (Electronic) REL-4P32-TP (Electronic) RIC-3S32-TP (Electronic IC)	50 50 5	.77 .80 .82	89 93 95	A	T-2	93 97 93	10	26 25 25
		277	50	VEL-3P32-TP (Electronic) VEL-4P32-TP (Electronic) VIC-3S32-TP (Electronic IC)	50 50 5	.31 .34 .34	83 91 93	A	T-2	93 97 93	10	26 25 25
(3) F40T8, (3) FO40T8	40	120 277	50 50	REL-3P32-TP (Electronic) VEL-3P32-TP (Electronic)	40,50 40,50	.93 .38	108 100	A	T-2	93	10	25

Four Lamps—High Power Factor

Lamp Data: Description	Watts	Circuit (Volts)	Min. Starting Temp. (°F.)	Catalog Number (All Class P)†	Notes	Line Current (Amps)	Input ANSI (Watts)	Sound Rating	Dimensions (Page 22)	Wiring Diagram No. (Page 24)	Shipping Data: Units Std. Ctn.	Weight Std. Ctn. (Lbs.)
(4) FBO16T8 (4) F17T8 (4) FO17T8	16 17 17	120	50	REL-4P32-TP (Electronic)	50	.57	66	A	T-2	97	10	25
		277	50	VEL-4P32-TP (Electronic)	50	.23	61	A	T-2	97	10	25
(4) FBO24T8 (4) F25T8 (4) FO25T8	24 25 25	120	50	REL-4P32-TP (Electronic)	50	.77	89	A	T-2	97	10	25
		277	50	VEL-4P32-TP (Electronic)	50	.32	85	A	T-2	97	10	25
(4) F32T8, (4) FO32T8, (4) FBO31T8	32	120	50	REL-4P32-TP (Electronic)	50	.97	112	A	T-2	97	10	25
		277	50	VEL-4P32-TP (Electronic)	50	.41	110	A	T-2	97	10	25

NOTES: 1. CBM Approved. 2. CSA Approved. 5. Mark V Integrated Circuit electronic ballast. 40. Will also operate FO17, FO25 and FO40T8 rapid start lamps. 49. Remote Mounting—One or two lamp remote mounting. For single lamp remote mounting, only "red lead" lamp can be mounted remote from fixture. Maximum remote mounting, 20 ft. lead length. 50. Parallel Connect ballast. Will instant start rapid start lamps.

†Ordering Information:
Units shown are furnished with Class P ADVAN-guard® Automatic Resetting Thermostat. Units packed in Individual Cartons—Add suffix—I.

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY Rcl
CHECKED BY
DATE FEBRUARY 1993
REV. 19__

INSTALL ELECTRONIC BALLAST & T8 LAMPS
ECO# D5

PROJECT 16-403-10

SHEET NO. 1 OF 1 SHEETS

DESCRIPTION OF ACTION

THIS RETROFIT WOULD REPLACE EXISTING FLUORESCENT BALLASTS AND LAMPS (ENERGY-SAVING CORE & COIL BALLASTS AND 34-WATT LAMPS) WITH ELECTRONIC BALLASTS AND F32/T8 LAMPS. BOTH KWH SAVINGS AND KW DEMAND SAVINGS WILL RESULT.

SCREENING ANALYSES

(1) 2-LAMP BALLAST & T8 LAMP RETROFIT - UNIT ANALYSIS

SAVINGS: $72W(\text{EXIST}) - 61W(\text{NEW}) = \frac{11W \times 2860\text{ HRS}}{1000\text{ W/kW}} = 31.5\text{ KWH/YR}$

LCC SAVINGS = $31.5\text{ KWH/YR} \times \$0.07454/\text{KW} \times 11.70\text{ UPW}^* +$

$.011\text{ kW} \times \$108.60/\text{kW} \times 11.12\text{ UPW}^*$

$= \$40.75$

COSTS: MATERIAL - $\$32 \times 1.08 = \$34.56$

LABOR - 31.00

$\$65.56 \times 1.30 \times 1.01 \times 1.10 \times 1.115 =$

TOTAL COST $106

PG&E REBATE ($12)

TOTAL INVESTMENT $94

SIR = $\$40.75/\$94$

$= 0.43$

(2) 3-LAMP BALLAST & T8 LAMP RETROFIT - UNIT ANALYSIS

SAVINGS: $115W(\text{EXIST}) - 91W(\text{NEW}) = \frac{24W \times 2860\text{ HRS}}{1000\text{ W/KW}} = 68.6\text{ KWH/YR}$

LCC SAVINGS = $68.6\text{ KWH/YR} \times \$0.07454/\text{KW} \times 11.70\text{ UPW}^* +$

$.024\text{ kW} \times \$108.60/\text{KW} \times 11.12\text{ UPW}^*$

$= \$88.80$ WHICH IS LESS THAN THE 2-LAMP BALLAST INVESTMENT COST.

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL	IMPROVE POWER FACTOR	PROJECT 16-403-10
CHECKED BY	ECO #D8	
DATE FEBRUARY 19 93		SHEET NO. 1 OF 13 SHEETS
REV. JUNE 19 93		

DESCRIPTION OF ACTION

APPLICATION OF POWER FACTOR CORRECTION CAPACITORS IS CONSIDERED FOR TWO GENERAL CONDITIONS: (1) INSTALLATION AT THE MAIN UTILITY METERING POINT AND (2) INSTALLATION AT EACH INDIVIDUAL OFFENDING MOTOR. LOCATION AT THE MAIN SERVICE POINT WILL REDUCE BILLING PENALTIES ONLY AND NOT IMPROVE LOAD CAPABILITIES OF THE DISTRIBUTION SYSTEM. INSTALLATION AT INDIVIDUAL MOTORS WILL FREE UP SYSTEM CAPACITY BY REDUCING THE AMOUNT OF MAGNETIZING CURRENT DRAWN FROM THE UTILITY SUPPLY.

(1) INSTALLATION @ PG&E METERING POINT – SAVINGS CALCULATIONS

DATA & ASSUMPTIONS:

a. PG&E RATE SCHEDULE A-20 INCLUDES A 0.06% ADJUSTMENT ON THE TOTAL BILLING FOR EACH 1% POWER FACTOR DIFFERENCE FROM 85%.

b. AVERAGE MAIN POST BILLINGS: $600,000 DURING SUMMER PERIOD; $400,000 DURING WINTER PERIOD

c. AVERAGE POWER FACTOR:

SUMMER PERIOD – 82/83%

WINTER PERIOD – 85/86%

d. SUMMER PEAK DEMAND – 3,160 KW

CALCULATIONS:

a. PEAK KVAR (EXISTING) = ~~kW~~ KW × TAN ($\cos^{-1}$ .825)

= 3,160 KW × TAN (34.41°)

= 2,165 KVAR

b. PEAK KVAR (CORRECTED TO 95%)

= 3,160 KW × TAN ($\cos^{-1}$ .95)

3,160 KW × TAN (18.19°)

1,039 KVAR

FORM 101-1/8

c. PEAK CORRECTION REQ'D = 2,165 - 1,039 KVAR
= 1,126 KVAR

d. ANNUAL SAVINGS* = $600,000 x 12% x .06%/1% PF = $4,320.
$400,000 x 9% x .06%/1% PF = 2,160

TOTAL SAVINGS $6,480/YEAR

* ASSUMING CORRECTION TO AN AVERAGE P.F. OF 95%

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE FEBRUARY 1993
REV. JUNE 1993

IMPROVE POWER FACTOR
ECO# D8

PROJECT 16-403-10
SHEET NO. 3 OF 13 SHEETS

(2) INSTALLATION OF P.F. CORRECTION CAPACITORS @ MOTOR LOADS

ANNUAL KWH SAVINGS DUE TO A REDUCTION IN MOTOR CIRCUIT I^2R LOSSES ARE ESTIMATED AS FOLLOWS (SEE NOTES):

HP RATING	MAX KVAR	CURRENT REDUCTION %	FLA @ 460 V	RESISTANCE Ω/1000'	LOSS I^2R(W)	NEW LOSS I^2R(W)	SAVINGS WATTS
5	2.5	22	7.6	1.620	17	10	21
7.5	3	20	11	1.620	35	23	36
10	4	18	14	1.620	57	38	57
15	5	18	21	1.018	81	54	78
20	6	17	27	0.640	84	58	78
25	7.5	17	34	0.640	133	92	123
30	8	16	40	0.410	118	83	102
40	15	16	52	0.410	200	141	177
50	17.5	15	65	0.259	197	142	165
60	20	15	77	0.164	175	126	147
75	25	14	96	0.129	214	158	168

HP RATING	MAX KVAR	CURRENT REDUCTION %	FLA @ 200V	RESISTANCE Ω/1000'	I^2R LOSS IN WATTS EXIST.	I^2R LOSS IN WATTS NEW	SAVINGS WATTS
2	1	24	7.8	1.620	18	10	24
3	1.5	23	11	1.620	35	21	42
5	2.5	22	17.5	1.620	89	54	105
7.5	3	20	25	1.018	115	73	126
10	4	18	32	0.640	118	79	117
15	5	18	53	0.410	207	140	201
20	6	17	68	0.259	216	149	201
25	7.5	17	85	0.259	337	232	315
30	8	16	100	0.102	292	206	258
40	15	16	130	0.129	312	277	345
50	17.5	15	163	0.081	387	280	321
60	20	15	193	0.064	429	310	357
75	25	14	240	0.043	446	330	348

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE FEBRUARY 1993
REV. JUNE 1993

IMPROVE POWER FACTOR
ECO # D8

PROJECT 16-403-10
SHEET NO. 4 OF 13 SHEETS

ASSUMPTIONS:

1. KVAR VALUES BASED ON RAISING FULL LOAD POWER FACTOR TO APPROX 95%.
2. MOTORS ASSUMED TO BE NEMA DESIGN B, T-FRAME, 1800 RPM
3. RESISTANCE OF MOTOR CIRCUIT ASSUMES CONDUCTOR SIZED AT 125% OF FULL LOAD AMPS AND A LENGTH OF 150 FEET.
4. MOTOR CIRCUIT SAVINGS IN WATTS = (EXIST I^2R – NEW I^2R) × 3

SCREENING ANALYSIS – 460V MOTORS

HP RATING	KVAR	KW SAVINGS	LABOR COST	MAT'L COST	TOTAL INVEST. [1] W/SIOH + DESIGN	BREAKEVEN OP HOURS
5	2.5	0.021	95	270	588	24,490
7.5	3	0.036	95	280	604	14,130
10	4	0.057	95	300	636	8,940
15	5	0.078	120	320	708	7,0[illegible]
20	6	0.078	120	340	740	7,400
25	7.5	0.123	120	355	765	4,380
30	8	0.102	120	370	789	5,780
40	15	0.177	120	485	974	3,720
50	17.5	0.155	145	515	1,062	4,580
60	20	0.147	145	540	1,103	5,565
75	25	0.168	145	605	1,208	5,280

1/ INVESTMENT = (LABOR + 1.08 × MAT'L) × 1.30 × 1.01 × 1.10 × 1.115

2/ BREAKEVEN OP HOURS / YEAR = $\dfrac{\text{TOTAL INVESTMENT} - \text{kW SAVINGS} \times \$108.60/\text{kW} \times 13.5}{\text{KW SAVINGS} \times \$0.07454/\text{kWH} \times 14.53}$

FORM 101-1/8

SCREENING ANALYSIS - 200V MOTORS

HP RATING	KVAR	KW SAVINGS	LABOR COST	MAT'L COST	TOTAL INVEST.[1] W/SIOH & DESIGN	BREAKEVEN[2] OP HOURS/YR
2	1	0.024	85	240	523	18,760
3	1.5	0.042	85	275	580	11,390
5	2.5	0.105	115	345	740	5,145
7.5	3	0.126	115	360	765	4,245
10	4	0.117	130	380	820	4,675
15	5	0.201	130	400	853	2,555
20	6	0.201	130	420	885	2,700
25	7.5	0.315	150	465	990	1,540
30	8	0.258	150	500	1,046	2,380
40	15	0.345	180	765	1,521	2,710
50	17.5	0.321	200	860	1,706	3,545
60	20	0.357	215	920	1,827	3,520
75	25	0.348	235	1,100	2,149	4,340

1/ INVESTMENT = (LABOR + 1.08 x MAT'L) x 1.30 x 1.01 x 1.10 x 1.115

2/ BREAKEVEN OP HOURS / YEAR = $\dfrac{\text{TOTAL INVESTMENT} - \text{KW SAVINGS} \times 108.60/\text{kw} \times 13.5^{c}}{\text{KW SAVINGS} \times {}^{*}0.07454 \times 14.53}$

LIFE CYCLE COST ANALYSES FOR MOTOR INSTALLATIONS MEETING THE MINIMUM BREAKEVEN HOURS/YR ARE DEVELOPED IN THE FOLLOWING SPREADSHEET

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE RCL JUNE 1993
REV. 19

IMPROVE POWER FACTOR

PROJECT FT. HUNTER LIGGETT

SHEET NO. 6 OF 13 SHEETS

CAPACITORS INSTALLED AT MOTOR LOAD

BUILDING	SUPPLY HP	SUPPLY KW SAVINGS	RETURN HP	RETURN KW SAVINGS	TOTAL KW. SAVINGS	USAGE HRS/YR	KWH SAVINGS
205	25	0.315	10	0.117	0.432	5,840	2,523
~~206~~	~~2@10~~[1]	~~0.114~~	–	–	~~0.114~~	~~7,300~~	~~832~~
207	25	0.315	10	0.117	0.432	5,840	2,523
208	25	0.315	10	0.117	0.432	5,840	2,523
210	10	0.117	–	–	0.117	8,760	1,025
229	25	0.315	10	0.117	0.432	5,840	2,523
230	25	0.315	10	0.117	0.432	5,840	2,523
					2.277		13,640

[1] 460V MOTORS; ALL OTHERS ARE 200V MOTORS

ANNUAL DEMAND SAVINGS = 2.277 KW × $108.60/KW = $247

ANNUAL MBTU SAVINGS = 13,640 KWH × .003413 MBTU/KWH

= 46.6

FORM 101-1/8

Rev 6/93

CONSTRUCTION COST ESTIMATE

DATE PREPARED: FEBRUARY 1993

SHEET 7 OF 13

PROJECT: EEAP LIMITED ENERGY STUDY

PROJ. NO. D8

LOCATION: FORT HUNTER LIGGETT, CALIFORNIA

ARCHITECT ENGINEER: KELLER & GANNON

BASIS FOR ESTIMATE:

- [X] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.:

ESTIMATOR: RCL

CHECKED BY: BJH

POWER FACTOR CORRECTION AT PG&E METERING POINT	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
1200 KVAR, 12KV PADMOUNTED CAPACITOR BANK INCLUDING INCOMING LINE SECTION AND CAPACITOR SWITCHING	-	LS	-	4,000	-	23,000	27,000
CONCRETE PAD & SITE WORK	-	LS	-	800	-	200	1,000
FEEDER TO PG&E METERING LOCATION	30	LF	25	750	20	600	1,350
QUOTATION FROM L&E ELECTRICAL SALES, INC. FOR ABB BROWN BOVERI EQUIPMENT DATED 2/18/93							
SUBTOTAL			-	5,550	-	23,800	29,350
GEN. CONDITIONS @ 8%			-	-	-	-	2,348
SUBTOTAL			-	-	-	-	31,698
CONTRACTOR OH & PROFIT @ 30%			-	-	-	-	9,509
SUBTOTAL			-	-	-	-	41,207
BOND @ 1%			-	-	-	-	412
SUBTOTAL			-	-	-	-	41,619
ESTIMATING CONTINGENCY @ 10%			-	-	-	-	4,162
TOTAL CONSTRUCTION COST			-	-	-	-	45,781

CONSTRUCTION COST ESTIMATE

DATE PREPARED: REV. JUNE 1993

PROJECT: EEAP LIMITED ENERGY STUDY PROJ D8

LOCATION: FORT HUNTER LIGGETT, CA.

ARCHITECT ENGINEER: KELLER & GANNON

BASIS FOR ESTIMATE:
- [X] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.:

ESTIMATOR: RCL

CHECKED BY: BIH

P.F. CORRECTION @ INDIVIDUAL MOTORS SUMMARY	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
1. 4 KVAR CAPACITOR	5	EA	130	650	380	1,900	2,550
2. 7.5 KVAR CAPACITOR	6	EA	150	900	465	2,790	3,690
SUBTOTAL				1,550		4690	6,240
GENERAL CONDITIONS @ 8%							499
SUBTOTAL							6,739
CONTRACTOR OH & PROFIT @ 30%							2,022
SUBTOTAL							8,761
BOND @ 1%							88
SUBTOTAL							8,849
ESTIMATING CONTINGENCY @ 10%							885
TOTAL PROBABLE CONSTRUCTION COST							9,735

U.S. GOVERNMENT PRINTING OFFICE : 1959 O—516148

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT HUNTER LIGGETT, CA REGION NO. 4 PROJECT NO. D8
PROJECT TITLE: IMPROVE POWER FACTOR FISCAL YEAR ____
DISCRETE PORTION NAME: POWER FACTOR CORRECTION AT PG AND E METERING POINT
ANALYSIS DATE: JUNE '93 ECONOMIC LIFE 20 PREPARER KELLER & GANNON

1. INVESTMENT COSTS:
A. CONSTRUCTION COST $ 45,781
B. SIOH $ 2,518
C. DESIGN COST $ 2,747
D. TOTAL COST (1A+1B+1C) $ 51,046
E. SALVAGE VALUE OF EXISTING EQUIPMENT $ ∅
F. PUBLIC UTILITY COMPANY REBATE $ ∅
G. TOTAL INVESTMENT (1D-1E-1F) $ 51,046

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS 10/92

ENERGY SOURCE	COST $/MBTU(1)	SAVING MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$		$		$
.. DIST	$		$		$
C. RESID	$		$		$
D. NG	$		$		$
E. PPG	$		$		$
F. COAL	$		$		$
G. SOLAR	$		$		$
H. GEOTH	$		$		$
I. BIOMA	$		$		$
J. REFUS	$		$		$
K. WIND	$		$		$
L. OTHER	$		$		$
M. DEMAND SAVINGS			$		$
N. TOTAL			$		$ ∅

3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) $ 6,480
(1) DISCOUNT FACTOR (TABLE A) 13.59
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) $ 88,063

B. NON RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS(+) COST(-)(1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS(+)COST(-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2+3Bd4) $ 88,063

4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bd1/ECONOMIC LIFE)): 7.88 YEARS
5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): $ 88,063
6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 1.73
7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.89 %

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT HUNTER LIGGETT CA. REGION NO. 4 PROJECT NO. D8
PROJECT TITLE: IMPROVE POWER FACTOR FISCAL YEAR
DISCRETE PORTION NAME: POWER FACTOR CORRECTION AT INDIVIDUAL MOTORS
ANALYSIS DATE: JUNE '93 ECONOMIC LIFE 20 PREPARER KELLER & GANNON

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 9,733		
B.	SIOH	$ 535		
C.	DESIGN COST	$ 584		
D.	TOTAL COST (1A+1B+1C)	$ 10,		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ ∅	
F.	PUBLIC UTILITY COMPANY REBATE		$ ∅	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 10,927

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS 10/92

ENERGY SOURCE	COST $/MBTU(1)	SAVING MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 21.84	46.6	$ 1,018	14.53	$ 14,792
.. DIST	$		$		$
C. RESID	$		$		$
D. NG	$		$		$
E. PPG	$		$		$
F. COAL	$		$		$
G. SOLAR	$		$		$
H. GEOTH	$		$		$
I. BIOMA	$		$		$
J. REFUS	$		$		$
K. WIND	$		$		$
L. OTHER	$		$		$
M. DEMAND SAVINGS			$ 247	14.53	$ 3,593
N. TOTAL			$ 1,265		$ 18,381

3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) $
(1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) $ ∅

B. NON RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS(+) COST(-)(1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS(+)COST(-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ ∅

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2+3Bd4) $ ∅

4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bd1/ECONOMIC LIFE)): 8.64 YEARS
5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): $ 18,381
6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 1.69
7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.78 %

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT HUNTER LIGGETT, CA REGION NO. 4 PROJECT NO. D8
PROJECT TITLE: IMPROVE POWER FACTOR FISCAL YEAR ____
DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: JUNE '93 ECONOMIC LIFE 20 PREPARER KELLER & GANNON

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 55,581		
B.	SIOH	$ 3,057		
C.	DESIGN COST	$ 3,335		
D.	TOTAL COST (1A+1B+1C)	$ 61,973		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ Ø	
F.	PUBLIC UTILITY COMPANY REBATE		$ Ø	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 61,973

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS 10/92

ENERGY SOURCE	COST $/MBTU(1)	SAVING MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 21.84	46.6	$ 1,018	14.53	$ 14,792
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$		$		$
E. PPG	$		$		$
F. COAL	$		$		$
G. SOLAR	$		$		$
H. GEOTH	$		$		$
I. BIOMA	$		$		$
J. REFUS	$		$		$
K. WIND	$		$		$
L. OTHER	$		$		$
M. DEMAND SAVINGS			$ 247		$ 3,593
N. TOTAL			$ 1,265		$ 18,381

3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) $ 6,480
(1) DISCOUNT FACTOR (TABLE A) 13.59
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) $ 88,063

B. NON RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS(+) COST(-)(1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS(+)COST(-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2+3Bd4) $ 88,063

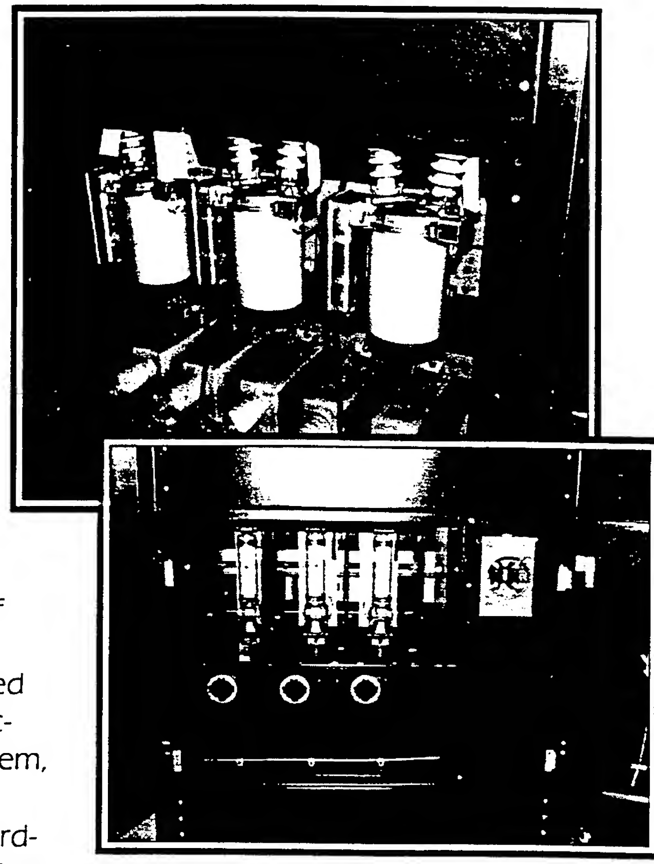
4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bd1/ECONOMIC LIFE)): 8.00 YEARS
5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): $ 106,444
6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 1.72
7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.86 %

ASEA BROWN BOVERI

PAD MOUNTED CAPACITOR ASSEMBLIES

Metal Enclosed Capacitor Assemblies Pad Mounted 5 and 15kV Class

Pad Mounted Capacitor Assemblies to meet maximum kVAR requirements, while maintaining aesthetic concerns, are available from ABB. These low profile, economical units are provided for both 5kV and 15kV class applications. Pad Mounted Capacitor Assemblies will help to correct poor power factor and reduce demand on substation transformers.



General Features

Rugged 11-gauge steel, finished with two coats of baked enamel, make the enclosures sturdy, weather resistant and attractive. Available in a bolted or welded construction, these units offer front and rear door access, (dead-front) barriers, and a 3-point latching system, with means for padlocking, to insure security. Other standard enclosure features include non-corrosive hardware, ventilation, lifting provisions and a domed roof.

Typically, these assemblies are (60"H x 60"W x 60"D) and will meet a wide range of capacitor application needs. Capacitors can be standard or inverted mount to allow for oil or vacuum switching arrangements, bushings, continuous ground bus, and individual or group fusing.

Various options are available such as key interlocks, control power transformer, pentahead bolts, and custom controls. All Pad Mounted Capacitor Assemblies are designed and built in accordance with applicable ANSI, NEMA, and IEEE standards.

- **Compact Design**
- **Economical**
- **Rugged Construction**
- **Tamper Resistant**
- **Available Through 2400 kVAR**

ASC Industries Inc.

2/18/93
8:40am

LGE

LGE ELECTRICAL SALES, INC.

RCL
TMR

FACSIMILE

Receiving Location: Keller & Gannon
Facsimile Number:
Attention: Dick Lennick
From: Doug Condon
Number of Pages in This Transmission: 1 Date: 2/18/93
Subject: ABB Pad Mounted Capacitor Banks

Based on our previous phone conversations, a budget price for a 1200 kVAR outdoor Pad mounted cap. Bank would be $23,000.

This includes an incoming line section and and a capacitor section with capacitor switching.

Approx. dimensions are 90" H x 120" W x 60" Deep Width may be decreased depending on incoming Line requirements

I am sending you descriptive literature under a seperate cover. Sorry this took so long.

Please call if you have any questions.

Doug Condon

1330 S. Bascom Ave., Ste. F • San Jose, CA 95128 • (408) 293-0755 • Fax (408) 293-0419

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

COMPUTED BY: RCL
CHECKED BY:
DATE: FEBRUARY 1993
REV. JUNE 1993

REPLACE MOTORS WITH HIGH EFFICIENCY UNITS
ECO # D9

PROJECT: 16-403-10

SHEET NO. 1 OF 2 SHEETS

DESCRIPTION OF ACTION

THIS PROJECT WOULD REPLACE EXISTING STANDARD-EFFICIENCY MOTORS WITH PREMIUM EFFICIENCY UNITS TO GENERATE BOTH KWH AND KW DEMAND SAVINGS.

SCREENING ANALYSIS

HOURS/YR OPER, REQ'D FOR REPLACEMENT TO BE JUSTIFIED: ALL OVER 8760 HR/YR

NOMINAL HP	% EFFICIENCY STD.	% EFFICIENCY PREMIUM [1]	LABOR COST	MAT'L COST [2]	TOTAL COST [3]	PG+E REBATE	TOTAL INVEST. [4]	BREAKEVEN OP HOURS/YEAR
1	75	82.5	80	205	485	30	455	106,100
2	79	84	80	275	607	40	567	
3	81	87.5	80	320	685	40	645	
5	82	87.5	80	385	798	50	748	54,330
7.5	84	89.5	85	480	971	60	911	
10	85	89.5	90	590	1,171	70	1,101	
15	86	91.0	110	825	1,162	85	1,077	
20	87	91.0	135	1,000	1,956	100	1,856	50,980
25	88	92.4	140	1305	2,705	120	2,585	
30	89	92.4	150	1,550	2,937	140	2,797	
40	89	93.0	175	2,030	3,812	160	3,652	
50	89	93.0	220	2,285	4,327	180	4,147	47,540
60	89	93.6	250	3,545	6,567	180	6,387	
75	90	94.1	295	4,145	7,682	200	7,482	
100	90	94.5	380	5,830	10,749	250	10,499	
125	90	94.5	495	6,850	12,708	350	12,358	
150	91	95.0	580	8,025	14,888	450	14,438	58,000

1) NEMA NOMINAL EFFICIENCY FOR 1800 RPM, TEFC MOTOR
2) 75% x LIST PRICE FOR BALDOR SUPER-E
3) TOTAL COST = (LABOR COST + 1.08 x MAT'L COST) x 1.30 x 1.01 x 1.10 x 1.115
4) TOTAL INVESTMENT = TOTAL COST − PG+E REBATE
5) BREAKEVEN OP HOURS/YR =

$$\frac{\text{TOTAL INVEST} - (HP \times .746 \times PCTG\ LOAD \times {}^{*}108.60/kW) \times \left(\frac{100}{STD\ EFF.} - \frac{100}{PREM\ EFF}\right)}{HP \times .746 \times PCTG\ LOAD \times {}^{*}.06223/kWh \times \left(\frac{100}{STD.\ EFF} - \frac{100}{PREM\ E}\right)}$$

WHERE PCTG. LOAD = .75

FORM 101-1/8

THUS, REPLACING EXISTING OPERATING STANDARD-EFFICIENCY MOTORS WITH PREMIUM-EFFICIENCY UNITS IS NOT COST EFFECTIVE.

THE INCREMENTAL COST OF REPLACING FAILED MOTORS WITH PREMIUM-EFFICIENCY RATHER THAN STANDARD-EFFICIENCY UNITS IS JUSTIFIED IN MOST CASES SINCE THE INVESTMENT REQUIRED IS ONLY THE ADDED COST OF THE PREMIUM-EFFICIENCY MOTOR. PG&E REBATES REDUCE THE COST EVEN FARTHER, FOR EXAMPLE:

NOMINAL HP	PREMIUM MOTOR COST	STANDARD MOTOR COST	COST DIFFERENCE	PG&E REBATE	NET INVESTMENT
5	385	280	105	50	55
20	1,000	800	200	100	100
50	2,285	1,775	510	180	330

ROUTE TO: ______ ______

______ ______

______ ______

______ File ___

Keller & Gannon

Engineers • Architects

DATE 3/3/93 TIME 9:15 AM / PM

RECORD OF TELEPHONE CONVERSATION

				Telephone No.
BETWEEN	RON	of	BUZZELL ELECTRIC	431-5526
AND	R.C. LENNIG	of	K&G	
SUBJECT	FORT HUNTER LIGGETT EEAP			
K&G PROJECT NO.	16-403-10			

(1) THE FOLLOWING ARE CURRENT LIST PRICES FOR BALDOR SUPER-E TEFC, 1800 RPM MOTORS THAT QUALIFY FOR PREMIUM EFFICIENCY REBATES FROM PG&E:

HP	COST	HP	COST
5	512	75	5,527
10	784	100	7,770
15	1098	125	9,135
20	1330	150	10,702
25	1741	200	12,479
30	2,068		
40	2,704		
50	3,047		
60	4,729		

(2) CONTRACTOR'S COST IS APPROX 75% OF LIST PRICE.

(3) ENERGY EFFICIENT MOTORS COST - ON AVERAGE - 75% OF ABOVE FIGURES.

RCL

BUZZELL ELECTRIC WORKS

SINCE 1909

PHONE: (415) 431-5526
FAX (415)431 6430

130 EIGHTH STREET
SAN FRANCISCO, CA 94103

DATE SENT: 10/7/92
TIME SENT: 8:10
PROJECT No.:
ORIGINAL: JCC /FILE ✓
COPY: TMR

TO: KELLER & GANNON
ATTN: CHRIS CASE
FAX #:

REFERENCE: YOUR REQUEST – Hi Eff Motrs

QTY.	DESCRIPTION	PART NO.	PRICE EACH
	1/4 HP 1Ø STANDARD EFFICIENCY	#L1203	131 EA
	1/2 "	#L1209	190 EA
	3/4 "	#L1307	220 EA
	1 3Ø HIGH EFFICIENCY	#EM3115	245 EA
	1 1/2 "	#EM3120T	290 EA
	2 "	#EM3155T	329 EA
	3 "	#EM3158T	380 EA
	5 "	#EM3212T	447 EA
	7 1/2 "	#EM3219T	567 EA

L RAE / forms / [illegible]

DELIVERY:

FROM: ~~MIKE~~ RON

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

ECO # D10

PROJECT 16-403-10

SHEET NO. 1 OF 34 SHEETS

DESCRIPTION OF ACTION

THIS PROJECT WOULD INSTALL AN ENERGY MONITORING AND CONTROL SYSTEM (EMCS) FOR THE MAJOR ENERGY-CONSUMING FACILITIES AT FORT HUNTER LIGGETT. THE SYSTEM WOULD CONSIST OF OFF-THE-SHELF MICROCOMPUTERS AND PERIPHERAL DEVICES, APPLICATIONS PROGRAMS, INSTRUMENTATION, CONTROL EQUIPMENT, AND A TWO-WAY FM RADIO DATA TRANSMISSION SYSTEM.

THE SYSTEM EVALUATED IS BASED ON THE METHODOLOGY DESCRIBED IN TM 5-815-2.

THE FOLLOWING EMCS APPLICATIONS PROGRAMS ARE CONSIDERED FOR FORT HUNTER LIGGETT:

ECO	
E-6	• SCHEDULED START/STOP
B-18	• OPTIMUM START/STOP
B-1	• DUTY CYCLING
B-6	• SUMMER/WINTER CHANGEOVER (O&M SAVINGS ONLY)
E-6	• DAY/NIGHT SETBACK
B-11	• ECONOMIZER
*	• CHILLED WATER RESET
B-5	• HOT WATER OUTSIDE AIR RESET
B-1	• DEMAND LIMITING
*	• BOILER MONITORING (O&M LABOR SAVINGS ONLY)

ENERGY SAVINGS ACHIEVABLE BY MOST OF THE ABOVE LISTED APPLICATIONS PROGRAMS CAN ALSO BE OBTAINED BY LOCAL CONTROL RETROFITS. ENERGY SAVINGS FOR THESE LOCAL RETROFITS WILL BE USED IN THIS EMCS ANALYSIS, WHERE APPLICABLE. ANALYSES OF LOCAL CONTROL RETROFITS ARE FOUND UNDER THE FOLLOWING ECO DESIGNATIONS:

B1 INSTALL LOAD SHEDDING SYSTEM (LOCAL CONTROLLERS)
B5 INSTALL OUTSIDE AIR TEMPERATURE RESET

* SAVINGS CALCULATIONS INCLUDED — ALL OTHERS IN RESPECTIVE ECO'S

FORM 101-1/8

Keller & Gannon
Engineers–Architects

COMPUTATION SHEET

COMPUTED BY RCL
CHECKED BY
DATE MARCH, 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 2 OF 34 SHEETS

B6 INSTALL TIME CLOCKS
B7 PROVIDE NIGHT SETBACK/SETUP
B11 INSTALL ECONOMIZER CYCLE
B16 AUTOMATE SUMMER/WINTER SWITCHOVER

INPUT/OUTPUT POINT SUMMARY

SYSTEM TYPE	ANALOG INPUTS (A/I)										D/I				A/O			D/O		
	SPACE TEMP	DUCT TEMP	LIQUID TEMP	SPACE/OA R.H.	PSIG, LIQUID	PSID, LIQUID	FLOW, LIQUID	DAMPER/VALVE POSN	WATTS	O2 SENSOR	PRESSURE SWITCH (WD)	DP SWITCH, AIR	AUX. CONTACT		CPA			CONTROLLER O/R	CONTROL RELAY	
SINGLE ZONE DX AHU	1	3										3						1	1	
HEATING & VENT. UNIT	1	2										3						1	1	
HOT WATER UNIT HEATER	1							1											1	
ELECTRIC UNIT HEATER	1																		1	
HOT WATER BOILER		1	5				2			1	1		3		1				2	
STEAM BOILER		1	5				4			1			3						1	
AIR COOLED CHILLER			1								1		2		1				1	
AIR COOLED DX COMPRESSOR													2						1	
ELECTRIC DHW HEATER													1						1	
HEAT PUMP													1						1	
WARM AIR FURNACE	1	2										2	1						2	
DUAL DUCT AHU	1 [1]	3 [3]		1 [1]				2			3	3			2			1	1	
FAN COIL UNIT	1		1								1	1	2						1	
VARIABLE AIR VOLUME AHU	1	3						1				3						1	1	

D/I = DIGITAL INPUT — 1/ 1 SENSOR PER ZONE
A/O = ANALOG OUTPUT — 3/ 5 SENSORS + 1/ZONE
D/O = DIGITAL OUTPUT

FORM 101-1/8

ECO D-10
SHEET 3 OF 34

BUILDING NO. TYPICAL

SYSTEM(S) SINGLE ZONE DX AHU

OCCUPANCY TIME

HARDWARE

GRAPHIC DISPLAY / POINT DESCRIPTION	OUTPUT DIGITAL: CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	OUTPUT ANALOG: CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	INPUT DIGITAL: PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	INPUT ANALOG: TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	FLOW
SUPPLY FAN	X							X						
RETURN FAN								X						
O.A. DAMPER				X										
MIXED AIR											X			
SUPPLY AIR											X			
RETURN AIR											X			
SPACE											X			
FILTER								X						
OUTSIDE AIR *														

SOFTWARE

POINT DESCRIPTION	ALARMS DIGITAL: CONTACT CLOSURE	ALARMS ANALOG: HIGH LIMIT	LOW LIMIT	RUN TIME	APPLICATION PROGRAMS: SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
SUPPLY FAN	X				X	X	X	X	X														
RETURN FAN	X																						
O.A. DAMPER									X	X	X												
MIXED AIR		X	X																				
SUPPLY AIR		X	X																				
RETURN AIR		X	X																				
SPACE		X	X																				
FILTER	X																						
OUTSIDE AIR *																							

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND O - (ON (OPEN)
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 4 OF 54

BUILDING NO. TYPICAL

SYSTEM(S) HEATING & VENTILATING UNIT

OCCUPANCY TIME

GRAPHIC DISPLAY X

HARDWARE

POINT DESCRIPTION	OUTPUT DIGITAL: CONTROL RELAY	OUTPUT DIGITAL: SOLENOID	OUTPUT DIGITAL: HAND/OFF/AUTO	OUTPUT DIGITAL: OFF/AUTO	OUTPUT ANALOG: CONTROL POINT ADJUSTMENT	OUTPUT ANALOG: POSITION ADJUSTMENT	INPUT DIGITAL: PRESSURE SWITCH	INPUT DIGITAL: DIFFERENTIAL PRESSURE SWITCH	INPUT DIGITAL: FLOW SWITCH	INPUT DIGITAL: AUXILIARY CONTACT	INPUT ANALOG: TEMPERATURE (DEGREES F)	INPUT ANALOG: % RELATIVE HUMIDITY	INPUT ANALOG: PSIG, PSIA, PSID	INPUT ANALOG: FLOW
SUPPLY FAN	X							X						
RETURN FAN								X						
O.A DAMPER				X										
MIXED AIR											X			
SUPPLY AIR											X			
FILTER								X						
SPACE											X			
OUTSIDE AIR *														

SOFTWARE

POINT DESCRIPTION	ALARMS DIGITAL: CONTACT CLOSURE	ALARMS ANALOG: HIGH LIMIT	ALARMS ANALOG: LOW LIMIT	ALARMS ANALOG: RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLER WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
SUPPLY FAN	X				X	X	X	X	X	X													
RETURN FAN	X																						
O.A DAMPER									X		X												
MIXED AIR		X	X																				
SUPPLY AIR		X	X																				
FILTER	X																						
SPACE		X	X																				
OUTSIDE AIR *																							

* ONE MEASUREMENT FOR ENTIRE SYSTEM.
** C - LAST COMMAND O - ON (OPEN)
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

BUILDING NO. TYPICAL

SYSTEM(S) HOT WATER UNIT HEATER

OCCUPANCY TIME

GRAPHIC DISPLAY X

POINT DESCRIPTION	HARDWARE – OUTPUT – DIGITAL: CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	HARDWARE – OUTPUT – ANALOG: CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	HARDWARE – INPUT – DIGITAL: PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	HARDWARE – INPUT – ANALOG: TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	POSITION	FLOW	SOFTWARE – ALARMS – DIGITAL: CONTACT CLOSURE	ALARMS – ANALOG: HIGH LIMIT	LOW LIMIT	RUN TIME	SOFTWARE – APPLICATION PROGRAMS: SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
HW SUPPLY VALVE		X												X										X														
SPARE											X						X	X																				
OUTSIDE AIR *																																						

* ONE MEASUREMENT FOR ENTIRE SYSTEM

** C - LAST COMMAND   O - ON (OPEN)
H - HIGH VALUE   F - OFF (CLOSED)
L - LOW VALUE   N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 6 OF 34

BUILDING NO.: TYPICAL

SYSTEM(S): ELECTRIC UNIT HEATER

OCCUPANCY TIME

HARDWARE — OUTPUT (DIGITAL, ANALOG); INPUT (DIGITAL, ANALOG); ALARMS (DIGITAL, ANALOG)

SOFTWARE — APPLICATION PROGRAMS

GRAPHIC DISPLAY / POINT DESCRIPTION	CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	FLOW	CONTACT CLOSURE	HIGH LIMIT	LOW LIMIT	RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE * *
CONTACTOR	X																		X	X	X	X															
SPACE											X					X	X																				
OUTSIDE AIR *																																					

* ONE MEASUREMENT FOR ENTIRE SYSTEM
* * C - LAST COMMAND (O - ON (OPEN))
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 7 OF 34

BUILDING NO. TYPICAL

SYSTEM(S) HOT WATER BOILER

OCCUPANCY TIME

GRAPHIC DISPLAY X

POINT DESCRIPTION	HARDWARE – OUTPUT – DIGITAL: CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	OUTPUT – ANALOG: CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	INPUT – DIGITAL: PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	LEVEL	FLAME FAILURE	INPUT – ANALOG: TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	% OXYGEN	FLOW	SOFTWARE – ALARMS – DIGITAL: CONTACT CLOSURE	ALARMS – ANALOG: HIGH LIMIT	LOW LIMIT	RUN TIME	APPLICATION PROGRAMS: SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
HW BOILER	X									X											X																			
MAIN HW SUPPLY													X				X		X	X																			X	
MAIN HW RETURN													X						X	X																			X	
BOILER HW SUPPLY					X								X				X		X	X													X						X	
BOILER HW RETURN													X						X	X																			X	
HOT WATER PUMP	X						X														X																			
FUEL SUPPLY													X		X																								X	
SAFETY ALARMS											X	X																											X	
FLUE GAS													X			X																							X	
FURNACE DRAFT															X																								X	
OUTSIDE AIR *																																								

* ONE MEASUREMENT FOR ENTIRE SYSTEM.
** C - LAST COMMAND; O - ON (OPEN); H - HIGH VALUE; F - OFF (CLOSED); L - LOW VALUE; N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 8 OF 34

BUILDING NO.
TYPICAL

SYSTEM(S)
STEAM BOILER

OCCUPANCY TIME

GRAPHIC DISPLAY

	HARDWARE – OUTPUT – DIGITAL				HARDWARE – OUTPUT – ANALOG		HARDWARE – INPUT – DIGITAL						HARDWARE – INPUT – ANALOG					SOFTWARE – ALARMS – DIGITAL	SOFTWARE – ALARMS – ANALOG			SOFTWARE – APPLICATION PROGRAMS																		
POINT DESCRIPTION	CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	FLAME FAILURE	LEVEL	TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	% OXYGEN	FLOW	CONTACT CLOSURE	HIGH LIMIT	LOW LIMIT	RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
STEAM BOILER	X									X								X			X																			
MAIN STEAM SUPPLY													X		X				X	X																			X	
BLR STEAM SUPPLY													X		X		X		X	X																			X	
CONDENSATE RETURN													X				X																						X	
FEED WATER SUPPLY													X		X		X																						X	
FUEL SUPPLY													X		X		X																						X	
SAFETY ALARMS											X	X																											X	
FLUE GAS													X			X																							X	
FURNACE DRAFT															X				X	X																			X	
OUTSIDE AIR *																																								

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND   O - ON (OPEN)
H - HIGH VALUE   F - OFF (CLOSED)
L - LOW VALUE   M - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 9 OF 34

BUILDING NO. TYPICAL

SYSTEM(S) AIR COOLED CHILLER

OCCUPANCY TIME [illegible]

GRAPHIC DISPLAY / POINT DESCRIPTION	HARDWARE – OUTPUT – DIGITAL: CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	OUTPUT – ANALOG: CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	INPUT – DIGITAL: PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	INPUT – ANALOG: TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	FLOW
CHILLED WATER PUMP	X						X							
CHILLED WATER SUPPLY					X						X			
CONDENSER FAN										X				
SAFETY ALARM										X				

POINT DESCRIPTION	SOFTWARE – ALARMS – DIGITAL: CONTACT CLOSURE	ALARMS – ANALOG: HIGH LIMIT	LOW LIMIT	RUN TIME	APPLICATION PROGRAMS: SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
CHILLED WATER PUMP	X			X																			
CHILLED WATER SUPPLY		X	X																X				
CONDENSER FAN	X			X																			
SAFETY ALARM	X																						

OUTSIDE AIR *

* ONE MEASUREMENT FOR ENTIRE SYSTEM.
** C - LAST COMMAND   O - ON (OPEN)
H - HIGH VALUE   F - OFF (CLOSED)
L - LOW VALUE   R - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 10 OF 34

BUILDING NO.
TYPICAL

SYSTEM(S)
AIR-COOLED
DX COMPRESSOR

OCCUPANCY TIME

GRAPHIC DISPLAY

HARDWARE — OUTPUT / INPUT

POINT DESCRIPTION	CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	FLOW
AIR COOLED DX COMPRESSOR	X									X				
SAFETY ALARM										X				

Column groups: OUTPUT — DIGITAL (CONTROL RELAY, SOLENOID, HAND/OFF/AUTO, OFF/AUTO), ANALOG (CONTROL POINT ADJUSTMENT, POSITION ADJUSTMENT); INPUT — DIGITAL (PRESSURE SWITCH, DIFFERENTIAL PRESSURE SWITCH, FLOW SWITCH, AUXILIARY CONTACT), ANALOG (TEMPERATURE (DEGREES F), % RELATIVE HUMIDITY, PSIG, PSIA, PSID, FLOW).

SOFTWARE — ALARMS

POINT DESCRIPTION	CONTACT CLOSURE	HIGH LIMIT	LOW LIMIT	RUN TIME
AIR COOLED DX COMPRESSOR	X			X
SAFETY ALARM	X			

Column groups: DIGITAL (CONTACT CLOSURE), ANALOG (HIGH LIMIT, LOW LIMIT, RUN TIME).

SOFTWARE — APPLICATION PROGRAMS

POINT DESCRIPTION	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
AIR COOLED DX COMPRESSOR	X	X	X	X															
SAFETY ALARM																			

OUTSIDE AIR *

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND   O - ON (OPEN)
H - HIGH VALUE   F - OFF (CLOSED)
L - LOW VALUE   N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

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BUILDING NO. TYPICAL

SYSTEM(S) ELECTRIC DHW HEATER

OCCUPANCY TIME

Group	Subgroup	Type	Point / Column	GRAPHIC DISPLAY / POINT DESCRIPTION: ELECTRIC DHW HEATER
HARDWARE	OUTPUT	DIGITAL	CONTROL RELAY	
HARDWARE	OUTPUT	DIGITAL	SOLENOID	X
HARDWARE	OUTPUT	DIGITAL	HAND/OFF/AUTO	
HARDWARE	OUTPUT	DIGITAL	OFF/AUTO	
HARDWARE	OUTPUT	ANALOG	CONTROL POINT ADJUSTMENT	
HARDWARE	OUTPUT	ANALOG	POSITION ADJUSTMENT	
HARDWARE	INPUT	DIGITAL	PRESSURE SWITCH	
HARDWARE	INPUT	DIGITAL	DIFFERENTIAL PRESSURE SWITCH	
HARDWARE	INPUT	DIGITAL	FLOW SWITCH	
HARDWARE	INPUT	DIGITAL	AUXILIARY CONTACT	X
HARDWARE	INPUT	ANALOG	TEMPERATURE (DEGREES F)	
HARDWARE	INPUT	ANALOG	% RELATIVE HUMIDITY	
HARDWARE	INPUT	ANALOG	PSIG, PSIA, PSID	
HARDWARE	INPUT	ANALOG	FLOW	
SOFTWARE	ALARMS	DIGITAL	CONTACT CLOSURE	X
SOFTWARE	ALARMS	ANALOG	HIGH LIMIT	
SOFTWARE	ALARMS	ANALOG	LOW LIMIT	
SOFTWARE	ALARMS	ANALOG	RUN TIME	
SOFTWARE	APPLICATION PROGRAMS		SCHEDULED START/STOP	X
SOFTWARE	APPLICATION PROGRAMS		OPTIMUM START/STOP	
SOFTWARE	APPLICATION PROGRAMS		DUTY CYCLING	X
SOFTWARE	APPLICATION PROGRAMS		DEMAND LIMITING	X
SOFTWARE	APPLICATION PROGRAMS		DAY/NIGHT SETBACK	
SOFTWARE	APPLICATION PROGRAMS		ECONOMIZER	
SOFTWARE	APPLICATION PROGRAMS		VENTILATION/RECIRCULATION	
SOFTWARE	APPLICATION PROGRAMS		HOT/COLD DECK RESET	
SOFTWARE	APPLICATION PROGRAMS		REHEAT COIL RESET	
SOFTWARE	APPLICATION PROGRAMS		STEAM BOILER SELECTION	
SOFTWARE	APPLICATION PROGRAMS		HOT WATER BOILER SELECTION	
SOFTWARE	APPLICATION PROGRAMS		HW OA RESET	
SOFTWARE	APPLICATION PROGRAMS		CHILLER SELECTION	
SOFTWARE	APPLICATION PROGRAMS		CHILLED WATER RESET	
SOFTWARE	APPLICATION PROGRAMS		CONDENSER WATER RESET	
SOFTWARE	APPLICATION PROGRAMS		CHILLER DEMAND LIMIT	
SOFTWARE	APPLICATION PROGRAMS		LIGHTING CONTROL	
SOFTWARE	APPLICATION PROGRAMS		REMOTE BOILER MONITORING CONTROL	
			FAILURE MODE **	

OUTSIDE AIR *

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND; O - ON (OPEN); H - HIGH VALUE; F - OFF (CLOSED); L - LOW VALUE; B - LOCAL LOOP

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BUILDING NO. TYPICAL

SYSTEM(S) HEAT PUMP

OCCUPANCY TIME

GRAPHIC DISPLAY

HARDWARE: OUTPUT (DIGITAL, ANALOG); INPUT (DIGITAL, ANALOG). SOFTWARE: ALARMS (DIGITAL, ANALOG); APPLICATION PROGRAMS

POINT DESCRIPTION	CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	FLOW	CONTACT CLOSURE	HIGH LIMIT	LOW LIMIT	RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
HEAT PUMP				X						X									X		X																
OUTSIDE AIR *																																					

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND   O - ON (OPEN)
H - HIGH VALUE   F - OFF (CLOSED)
L - LOW VALUE   N - LOCAL LOOP

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BUILDING NO. TYPICAL

SYSTEM(S) WARM AIR FURNACE

OCCUPANCY TIME

	HARDWARE																			
	OUTPUT								INPUT											
	DIGITAL					ANALOG			DIGITAL							ANALOG				
GRAPHIC DISPLAY / POINT DESCRIPTION	CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO		CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT		PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT				TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID		FLOW
DIRECT FIRED FURNACE	X											X								
SUPPLY FAN	X									X										
MIXED AIR																X				
SUPPLY AIR																X				
SPACE																X				
FILTER										X										
OUTSIDE AIR *																				

	SOFTWARE																												
	ALARMS							APPLICATION PROGRAMS																					
	DIGITAL			ANALOG																									
POINT DESCRIPTION	CONTACT CLOSURE			HIGH LIMIT	LOW LIMIT	RUN TIME		SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL				FAILURE MODE **
DIRECT FIRED FURNACE	X							X	X	X	X																		
SUPPLY FAN	X							X	X	X	X	X																	
MIXED AIR																													
SUPPLY AIR																													
SPACE																													
FILTER																													
OUTSIDE AIR *																													

* ONE MEASUREMENT FOR ENTIRE SYSTEM.
** C - LAST COMMAND O - ON (OPEN)
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO P-10
SHEET 12 OF 34

BUILDING NO. TYPICAL / SYSTEM(S) DUAL DUCT AHU / OCCUPANCY TIME	HARDWARE															SOFTWARE																						
	OUTPUT						INPUT									ALARMS				APPLICATION PROGRAMS																		
	DIGITAL				ANALOG		DIGITAL				ANALOG					DIGITAL	ANALOG																					
GRAPHIC DISPLAY / POINT DESCRIPTION	CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	POSITION	FLOW	CONTACT CLOSURE	HIGH LIMIT	LOW LIMIT	RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE * *
SUPPLY FAN	X							X								X				X	X	X	X	X														
RETURN FAN								X								X																						
O.A DAMPER				X										X										X	X	X												
MIXED AIR											X						X	X																				
HOT DECK					X						X						X	X									X											
COLD DECK					X						X						X	X									X											
SUPPLY/ZONE											X																											
ZONE DAMPER														X													X											
RETURN AIR											X						X	X																				
ZONE SPACE											X	X					X	X									X											
FILTER								X								X																						
OUTSIDE AIR *																																						

* ONE MEASUREMENT FOR ENTIRE SYSTEM.
** C - LAST COMMAND, O - ON (OPEN), H - HIGH VALUE, F - OFF (CLOSED), L - LOW VALUE, M - LOCAL LOOP.

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 13 OF 34

BUILDING NO. TYPICAL

SYSTEM(S) FAN COIL

OCCUPANCY TIME

GRAPHIC DISPLAY

HARDWARE

POINT DESCRIPTION	OUTPUT DIGITAL: CONTROL RELAY	OUTPUT DIGITAL: SOLENOID	OUTPUT DIGITAL: HAND/OFF/AUTO	OUTPUT DIGITAL: OFF/AUTO	OUTPUT ANALOG: CONTROL POINT ADJUSTMENT	OUTPUT ANALOG: POSITION ADJUSTMENT	INPUT DIGITAL: PRESSURE SWITCH	INPUT DIGITAL: DIFFERENTIAL PRESSURE SWITCH	INPUT DIGITAL: FLOW SWITCH	INPUT DIGITAL: AUXILIARY CONTACT	INPUT DIGITAL: LIMIT SWITCH	INPUT ANALOG: TEMPERATURE (DEGREES F)	INPUT ANALOG: % RELATIVE HUMIDITY	INPUT ANALOG: PSIG, PSIA, PSID	INPUT ANALOG: FLOW
DUAL TEMP PUMP	X							X							
DUAL TEMP VALVE							X				X				
SUPPLY WATER												X			
FAN COIL FAN										X					
SPARE												X			
OUTSIDE AIR *															

SOFTWARE

POINT DESCRIPTION	ALARMS DIGITAL: CONTACT CLOSURE	ALARMS ANALOG: HIGH LIMIT	ALARMS ANALOG: LOW LIMIT	ALARMS ANALOG: RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
DUAL TEMP PUMP	X				X	X	X	X	X														
DUAL TEMP VALVE	X																						
SUPPLY WATER		X	X																				
FAN COIL FAN	X																						
SPARE		X	X																				
OUTSIDE AIR *																							

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND O - ON (OPEN)
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 14 OF 34

BUILDING NO. TYPICAL

SYSTEM(S) VAV - AHU

OCCUPANCY TIME

HARDWARE

GRAPHIC DISPLAY / POINT DESCRIPTION	OUTPUT DIGITAL: CONTROL RELAY	OUTPUT DIGITAL: SOLENOID	OUTPUT DIGITAL: HAND/OFF/AUTO	OUTPUT DIGITAL: OFF/AUTO	OUTPUT ANALOG: CONTROL POINT ADJUSTMENT	OUTPUT ANALOG: POSITION ADJUSTMENT	INPUT DIGITAL: PRESSURE SWITCH	INPUT DIGITAL: DIFFERENTIAL PRESSURE SWITCH	INPUT DIGITAL: FLOW SWITCH	INPUT DIGITAL: AUXILIARY CONTACT	INPUT ANALOG: TEMPERATURE (DEGREES F)	INPUT ANALOG: % RELATIVE HUMIDITY	INPUT ANALOG: PSIG, PSIA, PSID	INPUT ANALOG: Position	INPUT ANALOG: FLOW
SUPPLY FAN	X							X							
RETURN FAN								X							
O.A. DAMPER				X										X	
MIXED AIR											X				
SUPPLY AIR											X				
RETURN AIR											X				
FILTER								X							
SPACE											X	X			
OUTSIDE AIR *															

SOFTWARE

GRAPHIC DISPLAY / POINT DESCRIPTION	ALARMS DIGITAL: CONTACT CLOSURE	ALARMS ANALOG: HIGH LIMIT	ALARMS ANALOG: LOW LIMIT	ALARMS ANALOG: RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
SUPPLY FAN	X				X	X		X	X														
RETURN FAN	X																						
O.A. DAMPER									X	X	X												
MIXED AIR		X	X																				
SUPPLY AIR		X	X																				
RETURN AIR		X	X																				
FILTER	X																						
SPACE		X	X																				
OUTSIDE AIR *																							

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND O - ON (OPEN)
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

ECO D-10
SHEET 15 OF 34

BUILDING NO. TYPICAL

SYSTEM(S) PROPANE-FIRED DHW HEATER

OCCUPANCY TIME

GRAPHIC DISPLAY

POINT DESCRIPTION	HARDWARE – OUTPUT – DIGITAL: CONTROL RELAY	SOLENOID	HAND/OFF/AUTO	OFF/AUTO	HARDWARE – OUTPUT – ANALOG: CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	HARDWARE – INPUT – DIGITAL: PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	FLOW SWITCH	AUXILIARY CONTACT	HARDWARE – INPUT – ANALOG: TEMPERATURE (DEGREES F)	% RELATIVE HUMIDITY	PSIG, PSIA, PSID	FLOW	SOFTWARE – ALARMS – DIGITAL: CONTACT CLOSURE	SOFTWARE – ALARMS – ANALOG: HIGH LIMIT	LOW LIMIT	RUN TIME	SOFTWARE – APPLICATION PROGRAMS: SCHEDULED START/STOP	OPTIMUM START/STOP	DUTY CYCLING	DEMAND LIMITING	DAY/NIGHT SETBACK	ECONOMIZER	VENTILATION/RECIRCULATION	HOT/COLD DECK RESET	REHEAT COIL RESET	STEAM BOILER SELECTION	HOT WATER BOILER SELECTION	HW OA RESET	CHILLER SELECTION	CHILLED WATER RESET	CONDENSER WATER RESET	CHILLER DEMAND LIMIT	LIGHTING CONTROL	REMOTE BOILER MONITORING CONTROL	FAILURE MODE **
PROPANE DHW HEATER		X								X					X				X																		
OUTSIDE AIR *																																						

* ONE MEASUREMENT FOR ENTIRE SYSTEM
** C - LAST COMMAND O - ON (OPEN)
H - HIGH VALUE F - OFF (CLOSED)
L - LOW VALUE N - LOCAL LOOP

U.S. ARMY CORPS OF ENGINEERS

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 16 OF 34 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG. NO.	SYSTEM TYPE	QUAN.	A/I SPACE TEMP	A/I DUCT TEMP	A/I LIQUID TEMP	A/I FLOW, LIQUID	A/I POSITION	A/I O2 SENSOR	A/I	A/I	D/I PRESSURE SWITCH	D/I D.P. SWITCH, AIR	D/I AUX. CONTACT	D/I	A/O CPA	A/O	A/O	D/O CONTROLLER O/R	D/O CONTROL RELAY	Σ
S79	ELEC UNIT HEATER	2	1																2	3
P80	HW BOILER	1		1	5	2		1			1		3		1				2	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	ELECTRIC DHW HEATER	1											1						1	30
	AIR COOLED DX COMPR.	1											2						1	
P81	HW BOILER	1		1	5	2		1			1		3		1				2	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	AIR COOLED DX COMPR.	1											2						1	32
	ELECTRIC DHW HTR	2											2						2	
P101	HW BOILER	1		1	5	2		1			1		3		1				2	
	SINGLE ZONE AHU	1	1	3								3						1	1	91
	AIR COOLED CHILLER	1			1						1		2		1				1	
	ELECTRIC UNIT HTR	30		30															30	
P116	SINGLE ZONE AHU	1	1	3								3						1	1	
	HEAT PUMP	1											1						1	13
	ELECTRIC DHW HTR	1											1						1	
T120	SINGLE ZONE DX AHU	2	2	6								6						2	2	
	WARM AIR FURNACE	1		2								2	1						2	
	DHW CIRC. PUMPS	2									2								2	31
	PROPANE UNIT HTR	2											1						1	

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
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DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 17 OF 34 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG. NO.	SYSTEM TYPE	QUAN.	A/I								D/I				A/O			D/O		Σ
			SPACE TEMP	DUCT TEMP	LIQUID TEMP	FLOW, LIQUID	POSITION	O_2 SENSOR			PRESSURE SWITCH	D.P. SWITCH, AIR	AUX. CONTACT		CPA			CONTROLLER O/R	CONTROL RELAY	
T121	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	AIR COOLED DX COMP.	1											2						1	14
	ELECTRIC DHW HTR	1											1						1	
S144	PROPANE UNIT HTR	4	1										4						4	9
S146	WARM AIR FURNACE	1	1	2								2	1						2	8
T156	ELECTRIC DHW HTR	1											1						1	2
T158	—																			
T161	WARM AIR FURNACE	2	2	4								4	2						4	22
	AIR COOLED DX COMP	2											4						2	
T162	WARM AIR FURNACE	2	2	4								4	2						4	22
	AIR COOLED DX COMP.	2											4						2	
S168	—																			
T172	—																			
P177	SINGLE ZONE DX AHU	1	1	3								3						1	1	12
	A.C. DX COMPRESSOR	1											2						1	
P178	WARM AIR FURNACE	2	2	4								4	2						4	
	A.C. DX COMPRESSOR	2											4						2	24
	DHW CIRC. PUMP	1									1								1	

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COMPUTATION SHEET

Keller & Gannon
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DATE MARCH 1993
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EMCS FEASIBILITY

PROJECT 16-403-10
SHEET NO. 18 OF 34 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG. NO.	SYSTEM TYPE	QUAN.	A/I: SPACE TEMP	DUCT TEMP	LIQUID TEMP	FLOW, LIQUID	POSITION	O_2 SENSOR	R.H.		D/I: PRESSURE SWITCH	D.P. SWITCH, AIR	AUX. CONTACT		A/O: CPA			D/O: CONTROLLER O/R	CONTROL RELAY	Σ
S182	SINGLE ZONE DX AHU	2	2	6								6						2	2	
	AIR COOL. DX COMPR.	2											4						2	26
	ELECTRIC DHW HTR	1											1						1	
S186	SINGLE ZONE DX AHU	1	1	3								3						1	1	12
	A/C DX COMPR.	1											2						1	
P190	HW BOILER	1		1	5	2		1			1		3		1				2	
	SINGLE ZONE DX AHU	2	1	3								3						1	1	30
	A.C. DX COMP.	2											2						1	
	ELECTRIC DHW HTR	1											1						1	
P197	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	A.C. DX COMP	1											2						1	14
	ELECTRIC DHW HTR	1											1						1	
S198	WARM AIR FURNACE	1	1	2								2	1						2	8
P205 & P205A	DUAL DUCT AHU	1	14		19		2		14			3			2			1	1	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	AIR COOLED CHILLER	1			1						1		2		1				1	59
	HW BOILER	1	1	5	2			1			1		3		1				2	
	A.C. DX COMPRESSOR	1											2						1	
	DHW CIRC. PUMPS	2									2								2	
	ELECTRIC DHW HTR	1											1						1	

FORM 101-1/8

Keller & Gannon
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COMPUTATION SHEET

COMPUTED BY RCL
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DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10
SHEET NO. 19 OF 24 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG. NO.	SYSTEM TYPE	QUAN.	A/I								D/I				A/O			D/O		Σ
			SPACE TEMP	DUCT TEMP	LIQUID TEMP	FLOW, LIQUID	POSITION	O_2 SENSOR	R.H.		PRESSURE SWITCH	D.P. SWITCH, AIR	AUX. CONTACT		CPA			CONTROLLER O/R	CONTROL RELAY	
P206	HW BOILER	2		2	10	4		2			2		6						4	
	SINGLE ZONE DX AHU	2	2	6								6						2	2	56
	A.C. DX COMPRESSOR	2											4						2	
	ELECTRIC DHW HTR	1											1						1	
P207 & P207A	HW BOILER	1		1	5	2		1			1		3						2	
	DUAL DUCT AHU	1	14		19		2		14			3			2			1	1	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	89
	A/C DX COMPRESSOR	1											2						1	
	ELECTRIC DHW HTR	1											1						1	
	DHW CIRC. PUMPS	2									2								2	
P208 & P208A	HW BOILER	1		1	5	2		1			1		3						2	
	DUAL DUCT AHU	1	14		19		2		14			3			2			1	1	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	A/C DX COMP.	1											2						1	89
	ELECTRIC DHW HTR.	1											1						1	
	DHW CIRC. PUMPS	2									2								2	
P209	HW BOILER	1		1	5	2	1				1		3						2	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	A.C. DX COMPR.	1											2						1	29
	ELECTRIC DHW HTR	1											1						1	

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COMPUTATION SHEET

Keller & Gannon
Engineers-Architects

COMPUTED BY RCL
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DATE MARCH 1993
REV. 19__

EMCS FEASIBILITY

PROJECT 16-403-10
SHEET NO. 20 OF 34 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG. NO.	SYSTEM TYPE	QUAN.	A/I SPACE TEMP	A/I DUCT TEMP	A/I LIQUID TEMP	A/I FLOW, LIQUID	A/I POSITION	A/I O_2 SENSOR	A/I	A/I	D/I PRESSURE SWITCH	D/I D.P. SWITCH, AIR	D/I AUX. CONTACT	D/I	A/O CPA	A/O	A/O	D/O CONTROLLER O/R	D/O CONTROL RELAY	Σ
S241	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	AIR COOLED CHILLER	1			1						1		2		1				1	15
	ELECTRIC DHW HTR	1											1						1	
P252	H.W. BOILER	1		1	5	2		1			1		3						2	
	HW UNIT HEATER	14	1				14												14	46
	ELECTRIC DHW HTR	1											1						1	
S283	PROPANE UNIT HEATER	3	1										3						3	13
	HEAT PUMP	1											1						1	
P287	SINGLE ZONE DX AHU	1	1	3								3						1	1	12
	A.C. DX COMPRESSOR	1											2						1	
S290	SINGLE ZONE AHU	1	1	3								3						1	1	
	AIR COOLED CHILLER	1		1							1		2						1	16
	DHW CIRC PUMP	1									1								1	
S291	SINGLE ZONE AHU	1	1	3								3						1	1	
	AC DX COMPRESSOR	1											2						1	27
	STEAM BOILER	1	1		5	4	1						3						1	
S295	H.W BOILER	1	1	1	5	2		1			1		3						2	
	AIR COOLED CHILLER	1			1						1		2		1				1	22
	FAN COIL UNIT	43	---	---	OMIT	---	---	---												

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon

Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 21 OF 34 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG NO.	SYSTEM TYPE	QUAN.	A/I								D/I				A/O			D/O		Σ
			SPACE TEMP	DUCT TEMP	LIQUID TEMP	FLOW, LIQUID	POSITION	O_2 SENSOR	R.H.		PRESSURE SWITCH	D.P. SWITCH, AIR	AUX. CONTACT		CPA			CONTROLLER O/R	CONTROL RELAY	
P210	HW BOILER	1		1	5	2		1			1		3						2	
	AIR COOLED CHILLER	1			1						1		2		1				1	
	AHU - DX	1	1	3							3							1	1	33
	A.C. DX COMPRESSOR	1											2						1	
P212	WARM AIR FURNACE	1	1	2								2	1						2	
	A.C. DX COMPRESSOR	1											2						1	11
P229 & P229A	H.W. BOILER	1		1	5	2		1			1		3						2	
	DUAL DUCT AHU	1	14		19		2		14			3			2			1	1	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	A.C DX COMPR.	1											2						1	89
	ELECTRIC DHW HTR	1											1						1	
	DHW CIRC. PUMPS	2									2								2	
P230 & P230A	H.W. BOILER	1		1	5	2		1			1		3						2	
	DUAL DUCT AHU	1	14		19		2		14			3			2			1	1	
	SINGLE ZONE DX AHU	1	1	3								3						1	1	
	A.C DX COMP.	1											2						1	89
	ELECTRIC DHW HTR.	1											1						1	
	DHW CIRC. PUMPS	2									2								2	
S238	VAV AHU	1	1	3			1		1			3						1	1	
	H.W. BOILER	1		1	5	2		1			1		3						2	31
	A.C. DX COMPRESSOR	1											2						1	
	DHW CIRC. PUMP	1									1								1	

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COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 22 OF 34 SHEETS

SUMMARY OF EMCS MONITORING & CONTROL POINTS

BLDG. NO.	SYSTEM TYPE	QUAN.	A/I								D/I				A/O			D/O		
			SPACE TEMP	DUCT TEMP	LIQUID TEMP	FLOW, LIQUID	POSITION	O_2 SENSOR	R.H. SENSOR	KW/KWH	PRESSURE SWITCH	D.P. SWITCH, AIR	AUX. CONTACT		CPA			CONTROLLER O/R	CONTROL RELAY	
P301	AHU - DX	1	1	3								3						1	1	FL
	A.C DX COMPRESSOR	1											2						1	
	COMPUTER RM A/C	4	—	— —	OMIT		CRITICAL		— —											
-	KW/KWH - HQ AREA	1								1										
	SYSTEM TOTALS		118	155	184	34	27	15	71	1	36	94	160		20			33	186	[illegible]

$\underbrace{\qquad\qquad\qquad}_{1,130}$

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB	ECO # D-10 EMCS	PROJECT 16-403-10
CHECKED BY BLH	CHILLED WATER RESET	FITL EEAP
DATE MARCH 1993		SHEET NO. 23 OF 34 SHEETS
REV. ____ 19__		

DESCRIPTION OF ACTION

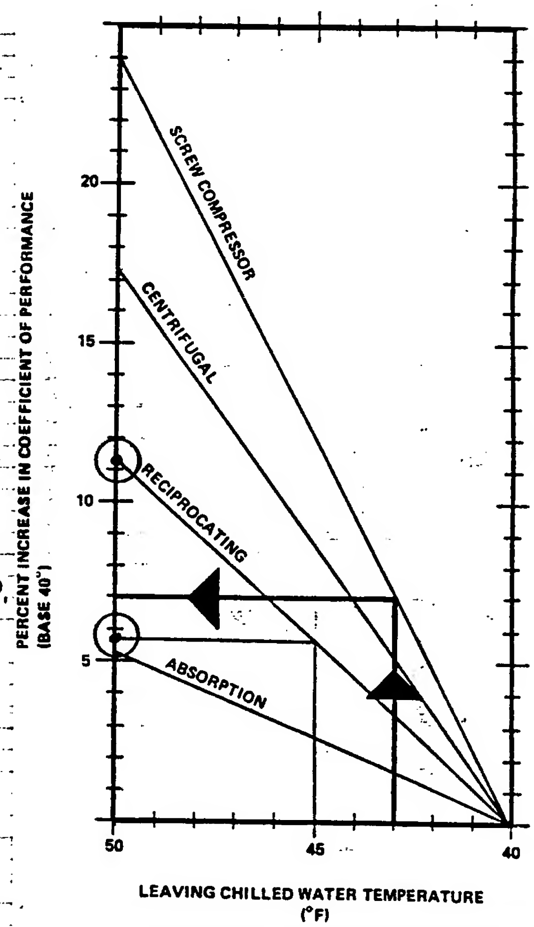
RAISE THE CHILLED WATER TEMPERATURE TO FOLLOW THE LOAD. INSTALL A LIMIT SWITCH IN EACH MODULATING OR DIVERSION VALVE TO MEASURE WHETHER THE VALVE IS FULLY OPEN OR PARTIALLY OPEN. ARRANGE THE CONTROL CIRCUITS SO THAT WHEN ALL COIL CONTROL VALVES ARE EITHER CLOSED OR IN A PARTIALLY OPEN POSITION (INDICATING LIGHT LOAD CONDITIONS), THE CHILLED WATER TEMPERATURE SUPPLY SET POINT SHOULD BE RAISED UNTIL ONE OR MORE COIL CONTROL VALVES RETURN TO THE FULLY OPEN POSITION.

FACILITIES INCLUDED

101	241
128	290
210	295

CALCULATIONS

ENERGY SAVINGS BASED ON REVISED COP'S GIVEN A RISE IN WATER TEMPERATURE FROM 45° TO 50° FOR DAYS WHEN OUTSIDE TEMPERATURES ARE ABOVE 30° BUT BELOW 93°DB. THE ADJACENT FIGURE FROM D.O.E. "ENERGY CONSERVATION IN EXISTING BUILDINGS" IS USED.



FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RJB
CHECKED BY BH
DATE MARCH 1993
REV. 19__

ECO* D-10 EMCS
CHILLED WATER RESET
COST SAVINGS

PROJECT 16-403-10
FTL EEAP
SHEET NO. 24 OF 34 SHEETS

COOLING DEGREE DAYS @ 93° DB = 358

@ 80° DB = 1,153

AVG. EFFICIENCY IMPROVEMENT

$$(11\% - 6\%) \times \left(\frac{1153 - 358}{1153} \right) = 3.5\%$$

CHILLER ENERGY USEAGE SUMMARY

BLDG	EXISTING USEAGE (KWH/YR)	NEW USEAGE (KWH/YR)	SAVINGS (KWH/YR)	SAVINGS $/YR
101	2,744	2,648	96	$7.00
128	29,186	28,164	1,021	$76.00
210	24,434	23,579	855	$64.00
241	16,431	15,856	575	$43.00
290	3,906	3,769	137	$10.00
295	81,379	78,531	2848	$212.00

FORM 101-1/8

CONSTRUCTION COST ESTIMATE	DATE PREPARED MARCH 1993	SHEET 25 OF 34

PROJECT: EEAP LIMITED ENERGY STUDY

LOCATION: FORT HUNTER LIGGETT, CA

ARCHITECT ENGINEER: KELLER & GANNON

BASIS FOR ESTIMATE:
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.:

ESTIMATOR: RCL

CHECKED BY: BJH

ENERGY MONITORING & CONTROL SYSTEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
COST SUMMARY							
CENTRAL CONTROL HARDWARE				1,200		18,170	19,370
SOFTWARE				63,250		-	63,250
TEST EQUIPMENT				-		23,000	23,000
REMOTE EMCS COMPONENTS				477,115		590,885	1,068,000
DATA TRANSMISSION SYSTEM				2,910		15,350	18,260
SYSTEM TESTING				98,450		-	98,450
TECHNICAL DOCUMENTATION				49,550		-	49,550
MAINTENANCE CONTRACT				58,000		-	58,000
OPERATOR TRAINING				12,750		-	12,750
SUBTOTAL				763,225		647,405	1,410,630
SALES TAX @ 8%						51,790	51,790
SUBTOTAL							1,462,420
CONTRACTOR OH & PROFIT @ 30%							438,725
SUBTOTAL							1,901,145
BOND @ 1%							19,010
SUBTOTAL							1,920,155
ESTIMATING CONTINGENCY @ 10%							192,015
TOTAL PROBABLE							
CONSTRUCTION COST							2,112,170
TOTAL COST - ROUNDED							2,100,000

CONSTRUCTION COST ESTIMATE

DATE PREPARED: MARCH 1993

SHEET 26 OF 34

PROJECT: EEAP LIMITED ENERGY STUDY

LOCATION: FORT HUNTER LIGGETT, CA

ARCHITECT ENGINEER: KELLER & GANNON

BASIS FOR ESTIMATE:
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.:

ESTIMATOR: RCL

CHECKED BY: BIH

ENERGY MONITORING & CONTROL SYSTEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
CENTRAL CONTROL HARDWARE							
1. SUPERVISORY CONTROL							
CENTER COMPUTER (IBM PS/2)	1	EA				9,900	9,900
2. ALARM & LOGGING PRINTERS	2	EA			660	1,320	1,320
3. LINE CONDITIONER/UPS	1	EA				1,250	1,250
4. DIAL-UP MODEM	1	EA				700	700
5. STREAMING TAPE BACKUP	1	EA				5,000	5,000
6. LABOR	40	MH	30	1,200			1,200
SUBTOTAL				1,200		18,170	19,370
SOFTWARE							
1. COMMAND SOFTWARE	–	LS	–	13,000		–	13,000
2. APPLICATIONS PROGRAMS	–	LS	–	22,000		–	22,000
3. DATABASE GENERATION	1,130	PT	25	28,250		–	28,250
SUBTOTAL				63,250			63,250
TEST EQUIPMENT							
1. FID SIMULATOR	1	EA		500		15,000	15,500
2. PORTABLE FID TESTER	1	EA	–	–	–	7,500	7,500
SUBTOTAL				500		22,500	23,000

CONSTRUCTION COST ESTIMATE	DATE PREPARED MARCH 1993	SHEET 27 OF 34
PROJECT: EEAP LIMITED ENERGY STUDY	BASIS FOR ESTIMATE: [X] CODE A (No design completed) [ ] CODE B (Preliminary design) [ ] CODE C (Final design) [ ] OTHER (Specify)	
LOCATION: FORT HUNTER LIGGETT, CA		
ARCHITECT ENGINEER: KELLER & GANNON		
DRAWING NO.	ESTIMATOR: RCL	CHECKED BY: BIH

ENERGY MONITORING & CONTROL SYSTEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
REMOTE EMCS COMPONENTS							
1. REMOTE TERMINAL UNIT (FID) [1]	45	EA	480	21,600	6,120	275,400	
2. SPACE TEMP. SENSOR	114	EA	282	32,148	205	23,370	
3. DUCT TEMP. SENSOR	155	EA	396	61,380	305	47,275	
4. SPACE / O.A. REL. HUMIDITY	71	EA	282	20,022	605	42,955	
5. GAGE PRESSURE, LIQUID	-	EA	426	-	625	-	
6. DIFF. PRESSURE, LIQUID	-	EA	570	-	895	-	
7. FLOW SENSOR, LIQUID	34	EA	480	16,320	1,155	39,270	
8. DAMPER/VALVE POSITION	27	EA	327	8,829	315	8,505	
9. KW/KWH TRANSDUCER	1	EA	267	267	580	580	
10. OXYGEN SENSOR	15	EA	282	4,230	750	11,250	
11. PRESSURE SWITCH, LIQUID	36	EA	417	15,012	250	9,000	
12. DIFF PRESSURE SWITCH AIR	94	EA	297	27,918	145	13,630	
13 AUXILIARY CONTACT	160	EA	285	45,600	85	13,600	
14. CONTROL POINT ADJ.	20	EA	411	8,220	760	15,200	
15. CONTROLLER OVERRIDE	33	EA	327	10,791	350	11,550	
16 CONTROL RELAY	186	EA	270	50,220	90	16,740	
17 LIQUID TEMP.	184	EA	840	154,560	340	62,560	
SUBTOTAL				477,117		590,885	1,068,002
[1] INCLUDES RADIO TRANSCEIVER							
DATA TRANSMISSION SYSTEM							
1. HEADEND TRANSCEIVER	1	EA	240	240	6,500	6,500	
2. HEADEND ANTENNA	1	EA	60	60	750	750	
3 RADIO TOWER	1	EA	1,260	1,260	1,500	1,500	
4. REMOTE ANTENNA (9.5dB)	15	EA	30	450	280	4,200	
5 REMOTE ANTENNA (2.5dB)	30	EA	30	900	80	2,400	
SUBTOTAL				2,910		15,350	18,260

CONSTRUCTION COST ESTIMATE	DATE PREPARED MARCH 1993	SHEET 28 OF 34
PROJECT: EEAP, LIMITED ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT HUNTER LIGGETT, CA	[X] CODE A (No design completed) [ ] CODE B (Preliminary design) [ ] CODE C (Final design) [ ] OTHER (Specify)	
ARCHITECT ENGINEER: KELLER & GANNON		
DRAWING NO.	ESTIMATOR: RCL	CHECKED BY: BIH

ENERGY MONITORING & CONTROL SYSTEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
SYSTEM TESTING							
1. FACTORY TEST	-	LS	-	-	-	-	5,000
2 FIELD TESTING	1,130	PT	65	73,450	-	-	73,450
3. VERIFICATION &							
ENDURANCE TESTS		LS	-	-	-	-	20,000
SUBTOTAL							98,450
TECHNICAL DOCUMENTATION							
1. TECHNICAL DATA PKG.							
- LUMP SUM	-	LS	-	-	-	-	20,000
- POINT COSTS	1,130	PT	35	39,550	-	-	39,550
SUBTOTAL							49,550
MAINTENANCE CONTRACT							
1. FIRST YEAR MAINTENANCE							
@ 11% OF INSTALLED							
EQUIPMENT COST		LS	-	-	-	-	58,000
SUBTOTAL							58,000
OPERATOR TRAINING							
1. TRAINING SESSIONS							
- LUMP SUM	-	LS	-	-	-	-	7,500
- PER STUDENT COSTS	3	EA	1,750	-	-	-	5,250
SUBTOTAL							12,750

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

COMPUTED BY RCL
CHECKED BY
DATE MARCH 1993
REV. 19

EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 29 OF 34 SHEETS

SENSORS & INSTRUMENTATION – UNIT POINT COST DEVELOPMENT [1]

ANALOG INPUTS	MAT'L COST	LABOR MH	LABOR COST
SPACE TEMPERATURE			
RTD & TRANSMITTER	150	1.4	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	205	9.4 @ $30 =	282
DUCT (AVG) TEMPERATURE			
AVERAGING RTD & XMITTER	250	4.2	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	305	13.2 @ $30 =	396
LIQUID TEMPERATURE			
RTD & TRANSMITTER	200	1.5	
THERMOWELL	85	4.5	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	340	14.0 @ $30 =	840
SPACE/OA RELATIVE HUMIDITY			
RH SENSOR & XMITTER	550	1.4	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	605	9.4 @ $30 =	282
GAUGE PRESSURE, LIQUID			
PRESSURE TRANSMITTER	525	3.2	
TAP	45	3.0	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	625	14.2 @ $30 =	426

[1] LABOR HOURS BASED ON HNDSP-88-207-ED-ME "LARGE EMCS COST ESTIMATING GUIDELINES"

FORM 101-1/8

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EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 30 OF 34 SHEETS

ANALOG INPUTS (CONT'D)	MAT'L COST	LABOR MH	LABOR COST
DIFFERENTIAL PRESSURE, LIQUID			
D.P. TRANSMITTER	750	5.0	
PRESSURE TAPS (2)	90	6.0	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	895	19.0 @ $30 =	570
FLOW, LIQUID			
D.P. (FLOW) XMITTER	850	5.0	
AVERAGING PITOT TUBE	250	3.0	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	1,155	16.0 @ $30 =	480
DAMPER/VALVE POSITION			
POTENTIOMETER	170	2.0	
TRANSDUCER	90	0.9	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	315	10.9 @ $30 =	327
ELECTRIC POWER [1]			
WATT TRANSDUCER	525	0.9	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	580	8.9 @ $30 =	267

[1]: EXISTING CT'S & PT'S

FORM 101-1/8

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EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 31 OF 34 SHEETS

	MAT'L COST	LABOR MH	LABOR COST
DIGITAL INPUTS			
PRESSURE SWITCH, LIQUID			
GAUGE PRESSURE SWITCH	150	3.2	
PRESSURE TAP	45	2.7	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	250	13.9 @ $30 =	417
DIFFERENTIAL PRESS. SWITCH, AIR			
AIR D.P. SWITCH	90	1.9	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	145	9.9 @ $30 =	297
AUXILIARY CONTACT			
TERMINAL STRIP	30	1.5	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	85	9.5 @ $30 =	285
ANALOG OUTPUTS			
CONTROL POINT ADJUSTMENT			
CPA CONTROLLER, PNEUMATIC	160	1.8	
I/P CONVERTER	250	1.0	
CONTROL RELAY	35	1.0	
EP VALVE	230	1.0	
PRESSURE REGULATOR	30	0.9	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	–	2.0	
TOTALS	760	13.7 @ $30 =	411

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
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EMCS FEASIBILITY

PROJECT 16-403-10

SHEET NO. 32 OF 34 SHEETS

DIGITAL OUTPUTS	MAT'L COST	LABOR MH	LABOR COST
CONTROLLER OVERRIDE			
CONTROL RELAY	35	1.0	
EP VALVE	230	1.0	
PRESSURE REGULATOR	30	0.9	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	—	2.0	
TOTALS	350	10.9 @ 30 =	327
CONTROL RELAY			
INTERPOSING RELAY	35	1.0	
WIRING & CONDUIT	55	6.0	
TERMINATIONS	—	2.0	
TOTALS	90	9.0 @ 30 =	270

FORM 101-1/8

Keller & Gannon
Engineers-Architects

COMPUTATION SHEET

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DATE MARCH 1993
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ECO* D-10 EMCS
COST SAVINGS

PROJECT K-403-10
FTR EMCS

SHEET NO. 33 OF 34 SHEETS

ENERGY SAVINGS

ECO		ELEC KWH/YR	OIL MBTU/YR	PROPANE MBTU/YR	
SCHEDULED START/STOP SUMMER/WINTER CHANGEOVER NIGHT SETBACK	B-6/7	215801	2460	3399	
OPTIMUM START STOP	B-18	3640	—	—	
DUTY CYCLING DEMAND LIMITING	B-1	16323	—	—	
ECONOMIZER	B-11	ECO NOT RECOMMENDED			
CHILLED WATER RESET *					
O/A RESET	B-5	5532			
BOILER MONITORING **					20,800
		241,296 = 824 MBTU/YR			20,800

ADDITIONAL MAINTENANCE SAVINGS OTHER THEN BOILER MONITORING RESULT IN

52 WEEKS/YR × 15 MH/WEEK × $40/MH = $32,000

Maint. Contract

TOTAL ANNUAL MAINT COST SAVE = 58,000 − $32,000 − $20,800
= $5,200

added cost per year

* PART OF ECO* D-10
** ANNUAL O/M SAVINGS ONLY

#PLANTS X 52 WEEKS/YR X 1 MH/WEEK
10 X 52 × 1 × $40/HR = $20,800

FORM 101-1/8

COMPUTATION SHEET

Keller & Gannon
Engineers–Architects

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DATE MARCH 1993
REV. 19

ECO D-10
EHCS COST SAVINGS

PROJECT 16-403-10 FHL-EEAP

SHEET NO. 33.1 OF 34 SHEETS

ECO B-1 DUTY CYCLING features are included with the EHCS project. While demand savings are not included with ECO B-1 calculations due to the lack of central control, demand savings are achievable with a central control such as an EHCS.

TOTAL LOAD CONTROLLED 673.5 KW
@ ECO B-1 Calculations

Loads are shut down 10 min / hr.

kW savings = 10/60 × 673.5 = 112.3 KW SAVED

AT \$108 /kW-Yr, Annual Cost Savings are: \$108 × 112.3 = \$12,124/year
Demand Cost Savings

FORM 101-1/8

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

ECO D-10
Sheet 34 of 34 -

Location: Fort Hunter Liggett, California	Region No. 4	Project No. 16-403-10
Project Title: EMCS		Fiscal Year FY96
Discrete Portion Name: ECO#D-10		
Analysis Date: March 1993	Economic Life: 15 YEARS	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$2,100,000		
B. SIOH	$115,500		
C. Design Cost	$126,000		
D. Total Cost (1A+1B+1C)	$2,341,500		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		($12,065)	
G. Total Investment (1D-1E-1F)			$2,329,435

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273-X Used for Discount Factors

Energy Source	Cost $/MTBU/(1)	Saving MBTU/YR(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$21.84	1,841.0		$40,207	11.70	$470,427
B. Dist	$4.98	2,460.0		$12,251	13.78	$168,816
C. Propane	$7.87	3,399.0		$26,750	14.16	$378,782
D. Demand	$108.6	112	kW	$12,128	11.70	$141,896
E. Other						
F. Total				$91,336		$1,159,921

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($5,200)		
(1) Discount Factor (Table A)		11.12	
(2) Discounted Savings/Cost (3A x 3A1)			($57,824)

B. Non Recurring Savings (+) or Cost (-)

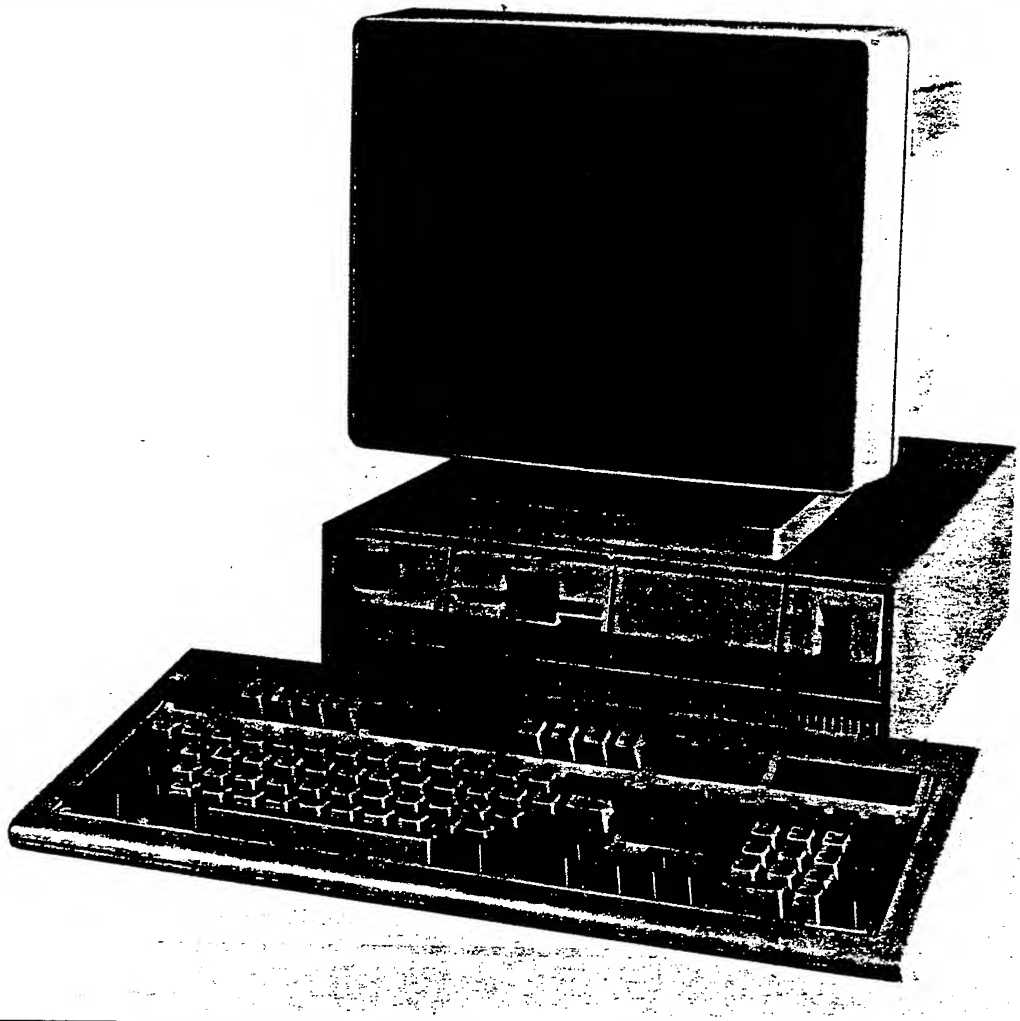
Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Doscounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($57,824)	
4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	27.0	Years
5. Total Net Discounted Savings (2F5+3C):	$1,102,097	
6. Savings to Investment Ratio (SIR) 5/1G:	0.47	
7. Adjusted Internal Rate of Return (AIRR):		

Eq. Cat.	Sec.	Item
R3	11	79

MOTOROLA

MOSCAD
Motorola SCADA IGC/M
Supervisory Control Center



The MOSCAD system Supervisory Control Central (IGC/M) will provide necessary central stations functions in a MOSCAD Supervisory Control and Data Acquisition (SCADA) system. When connected to the appropriate Front End Processor, the IGC/M is capable of monitoring and controlling MOSCAD remote terminal units via either conventional or trunked two-way radio, microwave backbone, or (with appropriate interface) multi-drop wire or fiber optic communications media. The video display offers high quality color presentations of alarm and of system status and telemetry conditions using either character or pixel graphics and alphanumeric text.

The IGC/M central may consist of a single computer that provides system information to a single operator.

Or several computers may be configured in a Local Area Network (LAN) to pass/share system data among several operators.

The industry standard IGC/M central software is a menu-driven database package that is completely user definable. Built-in prompts and help screens support definition of graphic displays, data calculations, automatic control sequences, text messages, and reports. Selected events and system activities are automatically logged to the system printer and hard drive for future use. The multi-tasking capability of the software allows you to add-to or modify your system database while the central continues to perform its monitoring and control functions.

MOSCAD System IGC/M Central

Feature/Benefit

Industry Standard SCADA Software—The IGC/M software package, based on THE FIX/DMACs™ SCADA software, provides a powerful data acquisition, control, and display package that can be easily tailored to match your system needs.

Supports a comprehensive package of data acquisition and control functions plus man-machine interface (MMI) that are normally found only on large expensive computer based systems.

Standard IBM PC Computer—The IGC/M software runs on an IBM™ PS/2 386-type computer, mixing easy operator interface with the flexibilitiy to handle the full capability of the MOSCAD remote terminal unit.

Allows the system operator(s) to efficiently monitor and control multiple MOSCAD remote terminal units via conventional or trunked radio, microwave baseband, or multidrop (leased and dial-up) wire or fiber optic communications media.

High Resolution Color Character or Pixel Graphics Display—An IBM PS/2 color display, along with either the standard 128 symbol ISA instrumentation character set or pixel graphics allows construction of dynamic visual displays that can represent any system operation.

Allows you to build highly detailed color graphic screens that can visually alert your operators to changing system conditions. This type of visual information can enable them to react quickly with great accuracy to system problems.

Multi-Tasking Capability—The IGC/M can run, under standard IBM PC DOS, foreground and multiple background tasks.

Allows operators to edit the system data base or print special reports while the central is performing its normal monitor and control functions.

Data Acquisition—The IGC/M can monitor and report on the condition of multiple digital, counter, and analog inputs from each of the MOSCAD remote terminal units in the system.

Allows the reporting of digital alarm or status changes, such as intrusion/fire alarms and pump runtimes, and the values of analog inputs or calculated data, such as motor speed, fluid levels and flows, and statistical averages.

Supervisory Control Outputs—The IGC/M can manually or automatically (by schedule or event) generate digital or analog control outputs to a MOSCAD remote terminal unit.

Provides for the direct control of electrical devices, such as motors, pumps, valves, emergency sirens, or tower lights. Also, allows you to proportionally control valves and vary the speed of fans or motors to change remote operating conditions.

System Printers—A printer may be connected to each IGC/M to record selected system alarms, status changes, and control actions. Add a second printer, either locally or remotely, for system reports.

Allows you to keep a printed log of selected system transactions while simultaneously printing system reports.

Secure Signalling—All IGC/M messages are transmitted using MDLC, a 7-layer OSI packet-type signalling format that was specifically developed to handle large amounts of data on two-way radio communication channels.

Ensures accurate and reliable operation with no false or erroneous controls, even during conditions with a high level of noise.

Contention or Polling—The IGC/M receives and displays status and analog value changes sent in autonomously from MOSCAD remote terminal units (contention) and/or in response to an interrogation (poll) generated by the IGC/M.

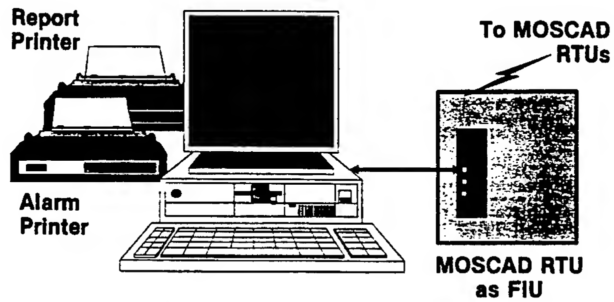
Contention reporting provides the IGC/M with fast screen updates of alarm or changes in monitored analog values. Polling ensures the timely update of the IGC/M's data base and detection of potential remote terminal unit failures.

Automatic Data Base Preparation—Significantly reduces the time required to make the IGC/M operational by integrating each MOSCAD RTU's data base into the central.

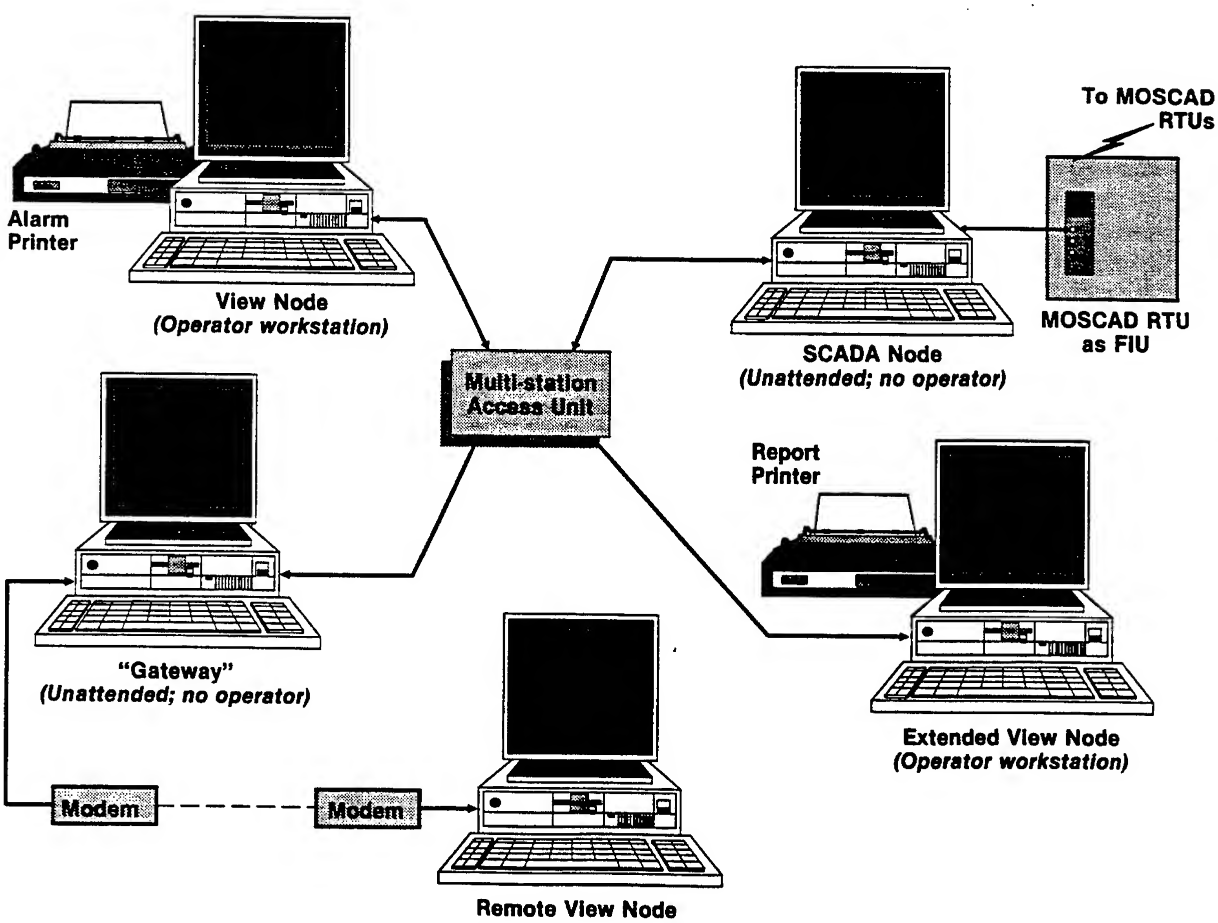
Preparing the display screens and linking dynamic display elements to the data base is all that remains.

Broadcast Capability—Commands and messages may be sent to groups of RTUs. The groupings may be changed dynamically.

Multiple RTUs will respond to a single broadcast transmission to simultaneously control multiple devices at multiple sites. The groupings need not be predefined during system design.



IGC/M in Stand Alone Configuration



IGC/M in Local Area Network Configuration

MOSCAD System IGC/M Central

Specifications

Hardware:	
Computer:	IBM PS/2 386-type (such as Model 55SX) computer with a 4 Mbyte RAM, one 60 Mbyte hard disk, one 3.5" high density floppy disk drive, math coprocessor, 2 serial and 2 parallel ports, mouse, and a 12" VGA color display. Alarm & report printers as needed. *(LAN hardware required in network configuration).*
Software:	THE FIX/DMACS with MOSCAD driver. DOS V3.3 and QEMM386 included.
Display Formats:	Character Graphics: 80 columns by 25 lines; 16 colors Pixel Graphics: 640 x 350 pixels (EGA mode) or 640 x 480 pixels (VGA mode); 16 colors
FIU:	Use an appropriate MOSCAD RTU model.
I/O Capability:	256 RTUs with 3000 total I/Os *(total I/Os per Stand-alone or SCADA node.)*
Control Modes:	Manual control; automatic loop control
Interrogation Modes:	Manual, event triggered, and scheduled. Rates adjustable from 1 second to several days in 1 second increments in multiple schedules or at predetermined dates, days and times.
Node Type:	
Stand Alone:	SCADA and VIEW, RTU interface with pixel graphics, historical trending, report generation, scheduler capability, and alarm handling.
L.A.N.:	SCADA node: RTU interface with pixel graphics and scheduler capability. View node: pixel graphics and alarm handling. Extended View node: pixel graphics, historical trending, report generation, scheduler capability, and alarm handling. Maximum number of nodes: 16.
General:	
Power:	117 Vac 60 Hz (800 VA per node); 230 Vac 50 Hz available
Temperature:	Operating: +15 to +32°C; 8 to 80% relative humidity, non-condensing

Winner 1988 Malcolm Baldrige National Quality Award

U.S.A. OFFICIAL SPONSOR OF THE 1992 US OLYMPIC TEAM

Support Services
Wherever Motorola sells, our product is backed by service. In the U.S., we have 900 authorized or company-owned centers. In addition, our products are serviced throughout the world by a wide network of company or authorized independent distributor service organizations.

MOTOROLA

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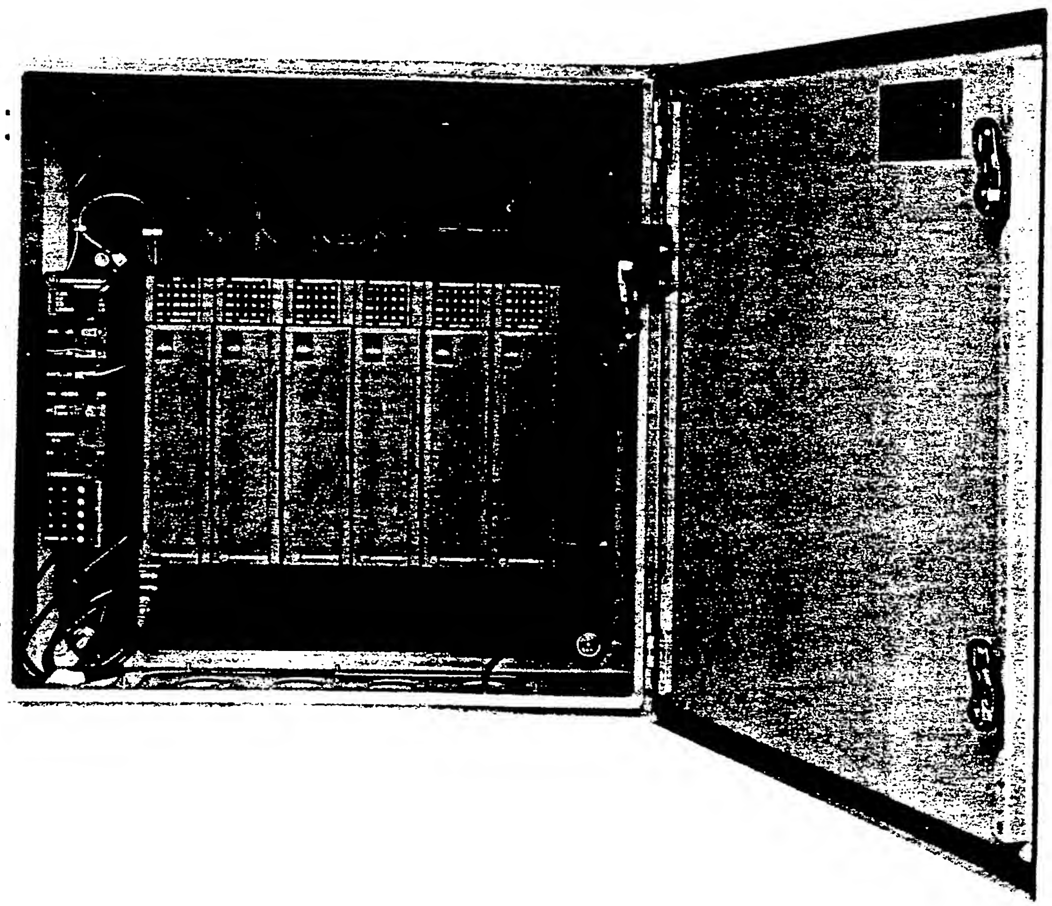
Specifications subject to change without notice.

R3-11-79

MOTOROLA

MOSCAD
Motorola SCADA
Remote Terminal Unit



Product Overview

The **MOSCAD** Remote Terminal Unit (RTU) provides a data collection unit with the intelligence required to operate in sophisticated Supervisory Control And Data Acquisition **(SCADA)** data systems. With MOSCAD, local processes can be thoroughly supervised; control decisions, utilizing data from both local and remote sources, can be made; informational messages to supervisory centrals or to other remote units can occur. MOSCAD utilizes reliable Motorola FM two-way radio as the message transmission medium to completely eliminate dependence on leased wireline networks.

MOSCAD can automatically make the control decisions required to manage the local process—no instructions or intervention by external supervisory equipment is required. These control, and other, actions are defined within MOSCAD in an advanced ladder-language format; the SCADA Application Development software program is available to assist in this effort. MOSCAD uses the MDLC communications protocol, which was specifically designed to transmit large amounts of data via FM two-way radio, when communications with supervisory or other remote units is required.

MOSCAD, Motorola SCADA, Remote Terminal Unit

Feature/Benefits

Local Intelligence—MOSCAD is a microprocessor based RTU with large memory capacity that can locally make control decisions based on status conditions and values from local and remote sources.

Local Intelligence permits control decisions without the need for real-time messages from other supervisory centers; MOSCAD can operate in sophisticated control systems.

Ladder Logic—MOSCAD uses an advanced symbolic *ladder-logic application language* to develop the data base conditions, values, and RTU profile that must exist for each control action, message transmission, etc. to occur.

Powerful applications may easily be defined using industry accepted ladder logic. The task is made easier by using the SCADA Application Development software and an IBM PC computer.

MDLC—MOSCAD uses the MDLC communication protocol for all data signalling.

Specifically developed for two-way radio use but completely applicable to wireline, microwave, and fiber optic media, MDLC permits large volumes of data to be quickly transferred between terminals using packet transmission techniques.

Upload/Download—MOSCAD, via the MDLC data transfer capability, uploads the data collected and calculated by the application program to a central site and receives downloaded changes in the application program and in the parameters that control how the application operates.

The process being supervised need not be static; operational variables and limits, and the process definition itself, can be easily changed and transmitted to the RTU. Site visits by maintenance personnel are not required.

Diagnostics—MOSCAD incorporates self-diagnostic software routines to help maintenance personnel identify and correct operational problems. The ladder-logic application itself can log operational problems and transmit that data to a supervisory terminal using MDLC.

Self diagnostics and error reporting capabilities, plus local LEDs, permit maintenance personnel to repair malfunctions in the shortest possible time.

Communications—MOSCAD permits communications to occur RTU-to-central and RTU-to-RTU. Communications may occur between individual units or may be "broadcast" to several units simultaneously.

Communications between any or all units in the system may occur.

Modular—The core capabilities of MOSCAD are present in the CPU module. Other modules provide digital and analog input and output capabilities. Each module provides LED indicators that monitor the operations of the module.

Modular construction permits configuring each RTU to meet the precise requirements of each application, and permits future expansion as the application expands. Maintenance personnel need only to replace modules to restore proper operations.

CPU Module—The CPU module contains the microprocessor and associated RAM/ROM to control the connected I/O modules, the radio, and the communication ports.

All core functions, including system, application, and communication software, are contained in this module.

I/O Modules—Digital and analog input, digital and analog output, and combination input/output modules are available for those on-site inputs and outputs.

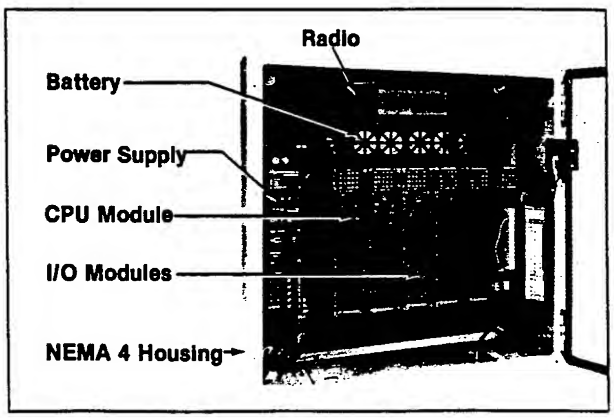
The digital input module includes high-speed counter capability. The relays on the digital output module provide either momentary or latch operation.

RS232/RS485 Ports—Connectors on the CPU module permit the connection of a terminal for application programming, a second terminal or printer for local operator I/O, and the radio.

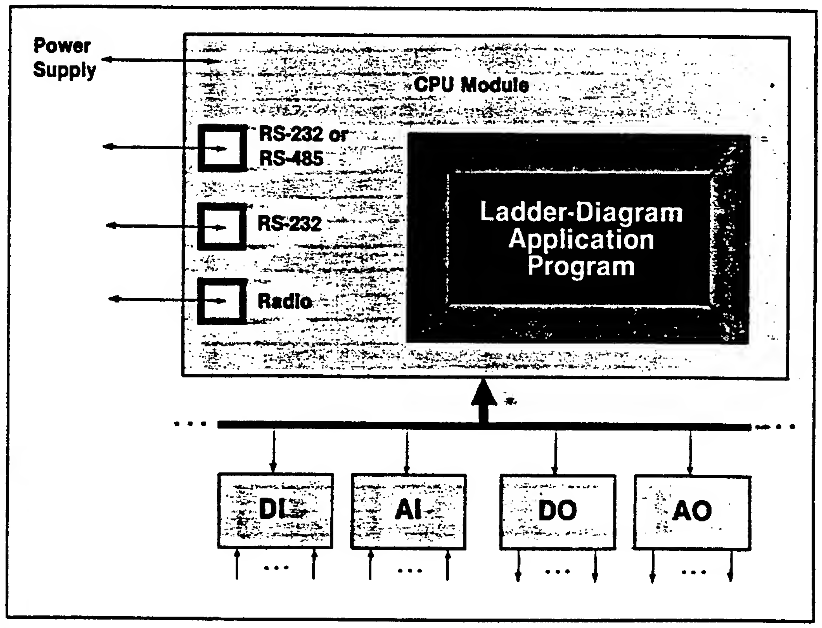
Multiple connectors, multiple communication protocols, and variable data speeds allow practically all external Data Terminal Equipment (DTE) to be connected to the CPU module.

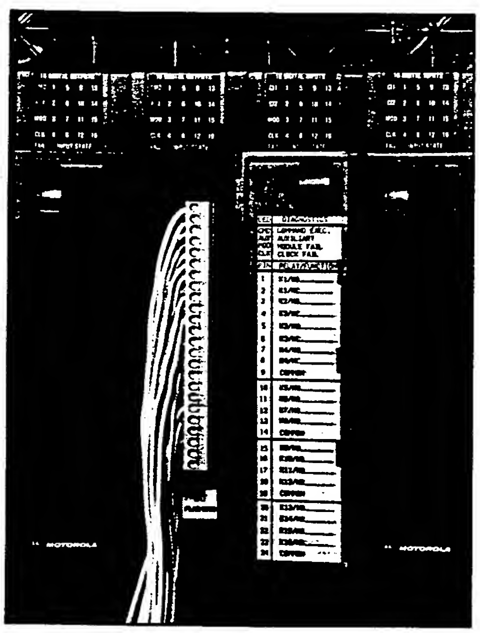
Dual Power Supply—MOSCAD is available with dual power supplies: a battery capable of fully powering the RTU, and an ac operated power supply that also recharges the battery.

Dual power sources insure continuing operation during ac power failures.

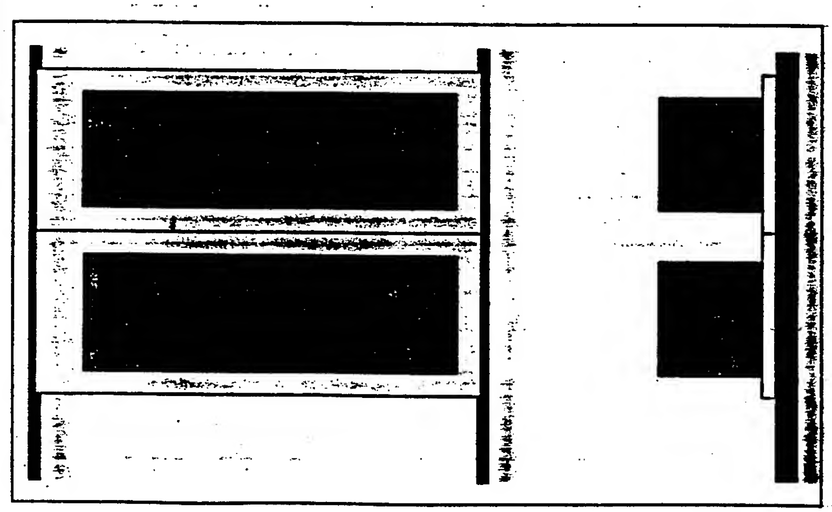


The *CPU Module* controls all operations





Plug-in I/O module showing LEDs and user connector



Rack-mount with space for 15 I/O modules

MOSCAD, Motorola SCADA, Remote Terminal Unit

Specifications

General	**Physical:**	NEMA-4 steel enclosure (1-6 modules): 19.7" × 19.7" × 8.3"
		Rack mount (1-8 modules): 19" × 10.5"
	Power Supply:	Dual: provides 13.8 Vdc @ 7A from 120/240 Vac 50/60 Hz; 13.8 Vdc 5 A-h battery
	Environmental:	−30 to +60 °C; 96% RH @ +50 °C
	Expansion:	Maximum 248 modules in racks of 16 (additional power supplies required)
CPU Module	**Processor:**	68302 (16/32 bit); CMOS; 16.6 MHz clock
	Memory:	256k (2 Mybte †) EPROM, 64k (256k †) RAM, 128k (512k †) FLASH († special order only; 2.5 Mbyte max.)
	Ports:	#1—RS232 at up to 9600 baud
		#2—RS232 at up to 9600 baud
		#3—Radio: 600-4800 baud, direct-FM, half/full duplex, synchronous, MDLC communication protocol
	Pushbuttons:	LED on/off/test; alarm acknowledge
	Power:	Provides 5 Vdc @ 2 A to expansion modules; Consumes 120 ma @ 12 Vdc
DI Module	**Inputs:**	16 digital inputs (500 Hz) plus 2 counter inputs (10 kHz rate; 50 μsec min pulse width); up to 14 ga. wire
	Filtering:	1-32 msec in hardware, longer by application program
	Isolation:	2.5 kV; opto-isolation; on-board dc/dc converter
	Protection:	Per IEEE SWC 472/585 (600V discharge)
	Power:	Consumes 5 Vdc @ 15 ma, 12 Vdc @ 15-60 ma
DO Module	**Relays:**	Type 1: 16 momentary or magnetic-latch; Type 2: 8 momentary or magnetic-latch
	Configuration:	Type 1: 12 Form A, 4 Form C; Type 2: 8 Form C
	Contact Rating:	60VA rating, not to exceed 250V or 2A; up to 14 ga. wire
	Isolation:	1 kV between contacts, 1.5 kV contact-to-coil
	Protection:	Per IEEE SWC 472/585 (600V discharge)
	Power:	Consumes 12 Vdc @ 15-300 ma
AI Module	**Inputs:**	Eight: 4 – 20 ma into 250 Ω; ±1 ma into 4 kΩ; ±1V or ±5V into 10 kΩ; up to 14 ga. wire
	Accuracy:	13 bit; ±0.05% FS plus 30 ppm/°C
	Conversion:	2 msec per input
	Isolation:	2.5 kV (optical) input-to-ground, 200 V_{peak} between inputs
	Protection:	Per IEEE SWC 472
	Power:	Consumes 5 Vdc @ 20 ma, 12 Vdc @ 15-60 ma
AO Module	**Outputs:**	Four: 4 – 20 ma into 250 Ω load from internal power source, into 750 Ω from external 24 Vdc power source; 0 – 5 V into 1k Ω minimum load. Up to 14 ga. wire. 2.5 kV optical isolation provided.
	Accuracy:	12 bit; ±0.1% FS plus 30 ppm/°C
Mixed I/O Module	**Inputs:**	8 digital inputs (may be used as counters)—see DI Module for performance specs.
		2 analog inputs; 4 – 20 ma only; 250 Ω input impedance; 10 bit, ± 0.5% FS plus 30 ppm/°C
	Outputs:	4 momentary or magnetic-latch: 2 Form A, 2 Form C—see DO Module for performance specs
Ladder Logic	**Processes:**	1 – 8 running simultaneously
	Elements:	12,000 with 128k FLASH memory (50,000 with 512k FLASH memory)

Element Types:

Inputs	*Outputs*
Logic (N.O., N.C., value)	Relay (open, close)
Comparator (=, ≠, >, <)	Timer (delay on, delay off, retentive)
Counters (up, down)	Binary – BCD conversion
Arithmetic (+, −, ×, ÷)	Variable – variable conversion
Boolean (AND, OR, XOR)	Text
Index	Jump
	Call – Return
	Scan
	Shift (logic & arithmetic; left, right)

FCC Information

Frequency Range	Model Number	Radio Type	Power Out	Rules Part	Emission Designators	Type Acceptance
136-174 MHz	F6973	MAXTRAC	20 watt	90	15K0F2D, 16K0F1D, 16K0F3E	ABZ9QCT3733
403-430, 450-470 MHz	F6974	MAXTRAC	20 watt	90	15K0F2D, 16K0F1D, 16K0F3E	ABZ9QCT4601
806-869 MHz Trunked	F6985	MAXTRAC	15 watt	15, 90	15K0F2D, 16K0F1D, 16K0F3E	ABZ9QCT5653
928-960 MHz (12.5 kHz)	F6956	DARCOM 9000	5 watt	94	12K5F2D, 12K5F3E, 12K5F9W	ABZ9QCC6612
192-960 MHz (25 kHz)	F6956	DARCOM 9000	5 watt	94	16K0F2D, 16K0F3E, 16K0F9W	ABZ9QCC6608
External radio (FSK)	F6909	External	Note 1	Note 1	Note 1	Note
External modem	F6900	None	None	N/A	N/A	N/A

Note 1: Determined by External Radio Model

MOTOROLA

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R3-11-78

APPENDIX E

Future Energy Consumption Calculations

APPENDIX E

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TABLES

TABLE E-1 SUMMARY FUTURE USE

Fac No.	Area (SF)	Total Future Energy Use Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kW-Hr/Yr	Energy Use per Floor SF Total Mil BTU/Yr	Total k BTU/SF-Yr
T 6	**1,090**		74	13,121	119	109.1
P 41A	**1,397**		58	21,055	129	92.6
P 41B	1,937		43	10,130	78	40.1
P 42A	1,937		60	22,824	138	71.1
P 42B	1,937		43	10,130	78	40.1
P 43A	1,937		60	22,824	138	71.1
P 43B	1,937		43	10,130	78	40.1
P 44A	1,937		60	22,824	138	71.1
P 44B	1,937		43	10,130	78	40.1
P 45A	1,937		60	22,824	138	71.1
P 45B	1,937		43	10,130	78	40.1
P 46	**2,089**		54	18,188	116	55.8
P 47	2,089		54	18,188	116	55.8
P 51A	**1,937**		60	22,824	138	71.1
P 51B	1,937		43	10,130	78	40.1
P 52A	1,937		60	22,824	138	71.1
P 52B	1,937		43	10,130	78	40.1
P 53	2,089		54	18,188	116	55.7
P 54	**2,089**		54	18,188	116	55.7
P 55	2,089		54	18,188	116	55.7
P 56	2,089		54	18,188	116	55.7
P 57	2,089		54	18,188	116	55.7
P 58	2,089		54	18,188	116	55.7
P 59	2,089		54	18,188	116	55.7
P 60	2,089		54	18,188	116	55.7
S 79	1,000			4,028	14	13.7
P 80	**9,093**		44	140,823	524	57.7
P 81	**6,719**		150	38,996	283	42.1
P 101	**6,171**		1,129	207,425	1,837	82.7
	3,046					
	4,721					
	8,273					
P 116	**1,126**		35	7,153	59	33.2
	662					
T 120	**3,636**		928	171,524	589	52.4
	2,653					
	4,949					
T 121	**4,952**		81	79,406	353	63.2
	628					
T 124	**2,001**		191	21,419	264	131.8
T 127	**2,250**		252	7,966	279	123.9
P 128	**20,196**		1,211	305,753	2,255	111.6
T 131	**998**		69	12,570	112	111.8
S 144	**7,172**		53	6,909	76	10.6
S 146	**4,042**		244	8,347	272	67.3
T 149	**1,196**		165	13,614	212	177.1
T 156	**1,753**			11,767	40	17.8
	497					
T 158	**1,859**			50	0.2	0.1
T 161	**2,250**		46	13,317	92	40.8
T 162	**2,250**		46	8,662	76	33.7
T 163	2,250		46	6,013	67	29.7

TABLE E-1 SUMMARY FUTURE USE

Fac No.	Area (SF)	Total Future Energy Use Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kW-Hr/Yr	Energy Use per Floor SF Total Mil BTU/Yr	Total k BTU/SF-Yr
T 164	2,250		46	9,737	80	35.3
T 165	2,250		46	9,737	80	35.3
T 166	2,250		46	6,013	67	29.7
T 167	2,250		46	6,013	67	29.7
S 168	6,560			178	1	0.1
T 172	800			22	0	0.1
P 177	3,599		6	30,174	109	30.3
P 178	3,599		117	41,949	260	72.2
S 182	3,000		22	204,002	718	239.4
S 186	1,920		84	18,438	147	76.4
P 190	2,720	306		44,515	458	168.5
S 197	2,100		262	117,984	665	81.5
	6,062					
S 198	1,090		49	5,304	67	61.6
P 205	35,820	1,412		326,553	2,527	61.7
P 205A	5,161					
P 206	16,768	4,722		306,765	5,769	344.0
P 207	35,820	1,675		319,685	2,766	67.5
P 207A	5,161					
P 208	35,820	1,714		325,741	2,826	68.9
P 208A	5,161					
P 209	3,320		82	205,360	783	235.9
P 210	10,973	2,971		319,912	4,063	370.2
P 211	-		1,184	36,436	1,308	-
P 212	8,907		752	86,888	1,048	117.7
P 219	3,212		471	46,441	630	196.0
P 229	40,915	1,495		308,786	2,549	55.3
P 229A	5,161					
P 230	35,820	1,662		336,971	2,812	68.6
P 230A	5,161					
S 235	3,000		46	32,302	157	52.2
S 236	3,000		47	32,302	157	52.4
S 237	3,000		115	32,302	225	75.0
S 238	14,548		529	105,521	889	61.1
P 240	3,000		38	32,302	148	49.5
S 241	10,000		148	216,853	741	74.1
S 243	3,000		33	32,302	143	47.8
S 244	3,000		33	32,302	143	47.8
S 246	3,000		33	32,302	143	47.8
S 247	3,000		38	32,302	148	49.5
P 252	12,299	686		53,478	868	70.6
P 256	5,294	340		29,380	440	83.2
P 259	13,667	860		55,735	1,050	76.8
S 283	4,000		120	10,336	155	38.8
S 286	3,000		57	31,224	163	54.5
P 287	5,584		172	80,676	447	80.1
S 288	3,000		57	28,590	154	51.5

TABLE E-1 SUMMARY FUTURE USE

Fac No.	Area (SF)	Total Future Energy Use Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kW-Hr/Yr	Energy Use per Floor SF Total Mil BTU/Yr	Total k BTU/SF-Yr
S 290	**14,856**		599	187,081	1,237	83.3
S 291	**7,400**		366	109,513	740	99.9
P 295	**46,593**		1,619	787,968	4,309	92.5
P 301	**10,800**		34	632,399	2,158	199.9
P 642	**995**		86	1,002	89	89.7
S 2201	**891**			1,155	4	4.4
Bldg Totals	625,458	17,843	13,410	7,192,590	54,695	87.4
Water Well				136,240	465	
Exterior Lighting				197,190	673	
Non-Scope SF	152,002			1,481,731	5,057	33.3
Grand Total	777,460	17,843	13,410	9,007,751	60,890	78.3

TABLE E-2 SUMMARY FUTURE HVAC & DHW ENERGY USE

Fac No.	Area (SF)	Future HVAC Energy Use Fuel Oil Mil BTU/Yr	Future HVAC Energy Use Propane Mil BTU/Yr	Future HVAC Energy Use Electric kWH/Yr	Future DHW Energy Use Fuel Oil Mil BTU/Yr	Future DHW Energy Use Propane Mil BTU/Yr	Future DHW Energy Use Electric kWH/Yr
T 6	**1,090**	0	23.9	4,972	0	39.7	0
P 41A	**1,397**	0	14.4	10,924	0	32.6	0
P 41B	1,937	0	0.0	0	0	32.6	0
P 42A	1,937	0	16.8	12,694	0	32.6	0
P 42B	1,937	0	0.0	0	0	32.6	0
P 43A	1,937	0	16.8	12,694	0	32.6	0
P 43B	1,937	0	0.0	0	0	32.6	0
P 44A	1,937	0	16.8	12,694	0	32.6	0
P 44B	1,937	0	0.0	0	0	32.6	0
P 45A	1,937	0	16.8	12,694	0	32.6	0
P 45B	1,937	0	0.0	0	0	32.6	0
P 46	**2,089**	0	11.1	7,726	0	32.8	0
P 47	2,089	0	11.1	7,726	0	32.8	0
P 51A	**1,937**	0	16.8	12,694	0	32.6	0
P 51B	1,937	0	0.0	0	0	32.6	0
P 52A	1,937	0	16.8	12,694	0	32.6	0
P 52B	1,937	0	0.0	0	0	32.6	0
P 53	2,089	0	11.1	7,726	0	32.6	0
P 54	**2,089**	0	11.1	7,726	0	32.6	0
P 55	2,089	0	11.1	7,726	0	32.6	0
P 56	2,089	0	11.1	7,726	0	32.6	0
P 57	2,089	0	11.1	7,726	0	32.6	0
P 58	2,089	0	11.1	7,726	0	32.6	0
P 59	2,089	0	11.1	7,726	0	32.6	0
P 60	2,089	0	11.1	7,726	0	32.6	0
S 79	1,000	0	0.0	1,565	0	0.0	0
P 80	**9,093**	0	43.9	4,890	0	0.0	13,813
P 81	**6,719**	0	150.0	9,488	0	0.0	26,931
P 101	**6,171**	0	490.6	(9,390)	0	88.0	0
	3,046	0	359.4	12,941	0	18.2	0
	4,721	0	0.0	134,563	0	60.7	0
	8,273	0	0.0	0	0	101.8	0
P 116	**1,126**	0	35.0	0	0	0.0	826
	662	0	0.0	1,550	0	0.0	0
T 120	**3,636**	0	429.2	11,757	0	28.0	0
	2,653	0	324.2	3,459	0	149.6	0
	4,949	0	0.0	0	0	(3.4)	0
T 121	**4,952**	0	47.0	25,804	0	34.5	0
	628	0	0.0	0	0	0.0	7,369
T 124	**2,001**	0	145.8	11,148	0	34.4	0
T 127	**2,250**	0	154.1	1,036	0	97.4	0
P 128	**20,196**	0	546.9	86,934	0	664.3	0
T 131	**998**	0	17.4	4,490	0	40.8	0
S 144	**7,172**	0	52.5	418	0	0.0	0
S 146	**4,042**	0	243.7	1,442	0	0.0	0
T 149	**1,196**	0	109.7	6,656	0	45.2	0
T 156	**1,753**	0	0.0	823	0	0.0	639
	497	0	0.0	0	0	0.0	0
T 158	**1,859**	0	0.0	0	0	0.0	0
T 161	**2,250**	0	46.3	2,638	0	0.0	0
T 162	**2,250**	0	46.3	2,638	0	0.0	0
T 163	2,250	0	46.3	2,638	0	0.0	0

TABLE E-2 SUMMARY FUTURE HVAC & DHW ENERGY USE

Fac No.	Area (SF)	Future HVAC Energy Use Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kWH/Yr	Future DHW Energy Use Fuel Oil Mil BTU/Yr	Propane Mil BTU/Yr	Electric kWH/Yr
T 164	2,250	0	46.3	2,638	0	0.0	0
T 165	2,250	0	46.3	2,638	0	0.0	0
T 166	2,250	0	46.3	2,638	0	0.0	0
T 167	2,250	0	46.3	2,638	0	0.0	0
S 168	**6,560**	0	0.0	0	0	0.0	0
T 172	**800**	0	0.0	0	0	0.0	0
P 177	**3,599**	0	6.1	10,869	0	0.0	0
P 178	**3,599**	0	63.8	12,405	0	53.0	0
S 182	**3,000**	0	22.0	3,121	0	0.0	3,059
S 186	**1,920**	0	83.7	5,480	0	0.0	0
P 190	**2,720**	306	0.0	36,505	0	0.0	2,056
S 197	**2,100**	0	262.4	16,361	0	0.0	418
	6,062	0	0.0	62,202	0	0.0	0
S 198	**1,090**	0	49.1	356	0	0.0	0
P 205	**35,820**	1,347	0.0	168,458	65	0.0	0
P 205A	**5,161**	0	0.0	0	0	0.0	407
P 206	**16,768**	3,840	0.0	108,696	882	0.0	
		0	0.0	0	0	0.0	0
P 207	**35,820**	1,338	0.0	168,577	337	0.0	0
P 207A	**5,161**	0	0.0	0	0	0.0	576
P 208	**35,820**	1,339	0.0	169,882	375	0.0	0
P 208A	5,161	0	0.0	0	0	0.0	629
P 209	**3,320**	0	82.3	56,989	0	0.0	37,445
P 210	**10,973**	1,003	0.0	153,565	1,968	0.0	0
P 211	-	0	1,183.5	36,436	0	0.0	0
P 212	**8,907**	0	733.6	47,849	0	18.3	
P 219	3,212	0	415.4	17,812	0	55.8	0
P 229	**40,915**	1,338	0.0	177,788	157	0.0	0
P 229A	5,161	0	0.0	0	0	0.0	568
P 230	**35,820**	1,338	0.0	185,146	324	0.0	0
P 230A	5,161	0	0.0	0	0	0.0	594
S 235	3,000	0	46.4	18,805	0	0.0	0
S 236	3,000	0	46.9	18,805	0	0.0	0
S 237	3,000	0	114.9	18,805	0	0.0	0
S 238	**14,548**	0	494.8	31,024	0	34.4	0
		0	0.0	0	0	14.1	0
P 240	3,000	0	38.2	18,805	0	0.0	0
S 241	**10,000**	0	147.6	162,955	0	0.0	2,719
		0	0.0	0	0	0.0	0
		0	0.0	0	0	0.0	0
S 243	3,000	0	33.0	18,805	0	0.0	0
S 244	3,000	0	33.0	18,805	0	0.0	0
S 246	3,000	0	33.0	18,805	0	0.0	0
S 247	3,000	0	38.2	18,805	0	0.0	0
P 252	**12,299**	686	0.0	20,340	0	0.0	2,732
P 256	5,294	340	0.0	10,742	0	0.0	4,590
P 259	13,667	860	0.0	19,377	0	0.0	2,560
S 283	**4,000**	0	119.8	452	0	0.0	0
		0	0.0	0	0	0.0	0
S 286	3,000	0	56.9	18,805	0	0.0	0
P 287	**5,584**	0	131.7	53,904	0	40.3	0
S 288	3,000	0	56.9	18,805	0	0.0	0

TABLE E-2 SUMMARY FUTURE HVAC & DHW ENERGY USE

Fac No.	Area (SF)	Future HVAC Energy Use Fuel Oil Mil BTU/Yr	Future HVAC Energy Use Propane Mil BTU/Yr	Future HVAC Energy Use Electric kWH/Yr	Future DHW Energy Use Fuel Oil Mil BTU/Yr	Future DHW Energy Use Propane Mil BTU/Yr	Future DHW Energy Use Electric kWH/Yr
S 290	**14,856**	0	556.4	141,463	0	42.1	0
		0	0.0	0	0	0.0	0
S 291	**7,400**	0	365.8	90,929	0	0.0	0
P 295	**46,593**	0	1,014.5	629,841	0	605.0	0
P 301	**10,800**	0	34.2	79,517	0	0.0	1,832
		0	0.0	0	0	0.0	0
		0	0.0	0	0	0.0	0
P 642	**995**	0	0.0	19	0	85.9	0
S 2201	**891**	0	0.0	349	0	0.0	0
Bldg Totals	625,458	13,735	9,988	3,364,812	4,107	3,132	109,763
Water Well							
Exterior Lighting							
Non-Scope SF	152,002	Nil	Nil	999,260	Nil	Nil	Nil
Grand Total	777,460	13,735	9,988	4,364,072	4,107	3,132	109,763

TABLE E-3 SUMMARY FUTURE LIGHTING & PROCESS ENERGY USE

Fac No.	Area (SF)	Lighting Energy kWH/Yr	Future Process Energy Use Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking & Other Prop Mil BTU/Yr
T 6	**1,090**	2,250	5,900	Included	10.5
P 41A	**1,397**	4,230	5,900	Included	10.5
P 41B	1,937	4,230	5,900	Included	10.5
P 42A	1,937	4,230	5,900	Included	10.5
P 42B	1,937	4,230	5,900	Included	10.5
P 43A	1,937	4,230	5,900	Included	10.5
P 43B	1,937	4,230	5,900	Included	10.5
P 44A	1,937	4,230	5,900	Included	10.5
P 44B	1,937	4,230	5,900	Included	10.5
P 45A	1,937	4,230	5,900	Included	10.5
P 45B	1,937	4,230	5,900	Included	10.5
P 46	**2,089**	4,562	5,900	Included	10.5
P 47	2,089	4,562	5,900	Included	10.5
P 51A	**1,937**	4,230	5,900	Included	10.5
P 51B	1,937	4,230	5,900	Included	10.5
P 52A	1,937	4,230	5,900	Included	10.5
P 52B	1,937	4,230	5,900	Included	10.5
P 53	2,089	4,562	5,900	Included	10.5
P 54	**2,089**	4,562	5,900	Included	10.5
P 55	2,089	4,562	5,900	Included	10.5
P 56	2,089	4,562	5,900	Included	10.5
P 57	2,089	4,562	5,900	Included	10.5
P 58	2,089	4,562	5,900	Included	10.5
P 59	2,089	4,562	5,900	Included	10.5
P 60	2,089	4,562	5,900	Included	10.5
S 79	1,000	764	1,700		0.0
P 80	**9,093**	10,036	112,084		0.0
P 81	**6,719**	1,518	1,058		0.0
P 101	**6,171**	8,423	0	39,420	0.0
	3,046	0	6,092	5,475	0.0
	4,721	0	4,000		0.0
	8,273	0	5,900	Included	10.5
P 116	**1,126**	3,170	481		0.0
	662	0	1,126		0.0
T 120	**3,636**	143,185	3,291		0.0
	2,653	0	2,800	6,899	0.0
	4,949	0	134		0.0
T 121	**4,952**	23,131	4,482	5,475	0.0
	628	0	13,144		0.0
T 124	**2,001**	4,370	5,900	Included	10.5
T 127	**2,250**	2,930	4,000		0.0
P 128	**20,196**	134,259	32,000	52,560	0.0
T 131	**998**	2,180	5,900	Included	10.5
S 144	**7,172**	0	6,491		0.0
S 146	**4,042**	5,179	1,727		0.0
T 149	**1,196**	1,059	5,900	Included	10.5
T 156	**1,753**	9,106	749		0.0
	497	0	450		0.0
T 158	**1,859**	0	50		0.0
T 161	**2,250**	8,643	2,036		0.0
T 162	**2,250**	5,063	961		0.0
T 163	2,250	3,375	NA		0.0

TABLE E-3 SUMMARY FUTURE LIGHTING & PROCESS ENERGY USE

Fac No.	Area (SF)	Lighting Energy kWH/Yr	Future Process Energy Use: Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking & Other Prop Mil BTU/Yr
T 164	2,250	5,063	2,036		0.0
T 165	2,250	5,063	2,036		0.0
T 166	2,250	3,375	NA		0.0
T 167	2,250	3,375	NA		0.0
S 168	**6,560**	0	178		0.0
T 172	**800**	0	22	Also see Bldg 182	
P 177	**3,599**	16,048	3,257		0.0
P 178	**3,599**	19,089	272	10,184	0.0
S 182	**3,000**	25,040	172,782		0.0
S 186	**1,920**	11,221	1,738		0.0
P 190	**2,720**	3,253	1,058	1,643	0.0
S 197	**2,100**	34,513	1,901		0.0
	6,062	0	2,589		0.0
S 198	**1,090**	3,961	986		0.0
P 205	**35,820**	90,408	32,417		0.0
P 205A	**5,161**	30,192	4,671		0.0
P 206	**16,768**	43,023		155,046	0.0
		0			0.0
P 207	**35,820**	83,669	32,000		0.0
P 207A	**5,161**	30,192	4,671		0.0
P 208	**35,820**	84,368	36,000		0.0
P 208A	5,161	30,192	4,671		0.0
P 209	**3,320**	5,736	6,640	98,550	0.0
P 210	**10,973**	126,081	37,308	2,957	0.0
P 211	-	0			0.0
P 212	**8,907**	33,566	5,473		0.0
P 219	3,212	25,722	2,907		0.0
P 229	**40,915**	84,368	11,200		0.0
P 229A	5,161	30,192	4,671		0.0
P 230	**35,820**	84,368	32,000		0.0
P 230A	5,161	30,192	4,671		0.0
S 235	3,000	10,783	2,715		0.0
S 236	3,000	10,783	2,715		0.0
S 237	3,000	10,783	2,715		0.0
S 238	**14,548**	44,905	13,166	-	0.0
		0	16,425	0	0.0
P 240	3,000	10,783	2,715		0.0
S 241	**10,000**	42,129	9,050		0.0
		0			0.0
		0			0.0
S 243	3,000	10,783	2,715		0.0
S 244	3,000	10,783	2,715		0.0
S 246	3,000	10,783	2,715		0.0
S 247	3,000	10,783	2,715		0.0
P 252	**12,299**	25,152	5,254		0.0
P 256	5,294	11,787	2,261		0.0
P 259	13,667	27,960	5,838		0.0
S 283	**4,000**	8,176	1,709		0.0
		0			0.0
S 286	3,000	9,704	2,715		0.0
P 287	**5,584**	15,604	11,168		0.0
S 288	3,000	9,704	81		0.0

TABLE E-3 SUMMARY FUTURE LIGHTING & PROCESS ENERGY USE

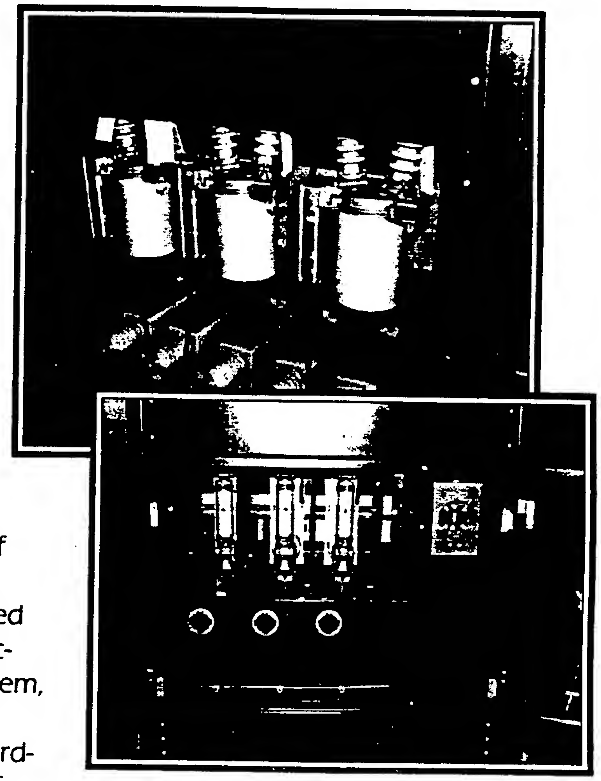
Fac No.	Area (SF)	Lighting Energy kWH/Yr	Future Process Energy Use Process kW-Hr/Yr	Cooking kW-Hr/Yr	Cooking & Other Prop Mil BTU/Yr
S 290	**14,856**	39,273	6,346		0.0
		0			0.0
S 291	**7,400**	15,423	3,161		0.0
P 295	**46,593**	112,527	45,600		0.0
P 301	**10,800**	46,003	9,774		0.0
		0	495,272		0.0
		0			0.0
P 642	**995**	983			0.0
S 2201	**891**	0	806		0.0
Bldg Totals	625,458	1,911,353	1,428,456	378,207	304.5
Water Well			136,240		
Exterior Lighting		197,190			
Non-Scope SF	152,002	475,935	6,536	Shop/Whse	
Grand Total	777,460	2,584,477	1,571,232	378,207	304.5
	625,458				
		2,108,543	1,564,696	378,207	305

PAD MOUNTED CAPACITOR ASSEMBLIES

ABB
ASEA BROWN BOVERI

Metal Enclosed Capacitor Assemblies Pad Mounted 5 and 15kV Class

Pad Mounted Capacitor Assemblies to meet maximum kVAR requirements, while maintaining aesthetic concerns, are available from ABB. These low profile, economical units are provided for both 5kV and 15kV class applications. Pad Mounted Capacitor Assemblies will help to correct poor power factor and reduce demand on substation transformers.



General Features

Rugged 11-gauge steel, finished with two coats of baked enamel, make the enclosures sturdy, weather resistant and attractive. Available in a bolted or welded construction, these units offer front and rear door access, (dead-front) barriers, and a 3-point latching system, with means for padlocking, to insure security. Other standard enclosure features include non-corrosive hardware, ventilation, lifting provisions and a domed roof.

Typically, these assemblies are (60"H x 60"W x 60"D) and will meet a wide range of capacitor application needs. Capacitors can be standard or inverted mount to allow for oil or vacuum switching arrangements, bushings, continuous ground bus, and individual or group fusing.

Various options are available such as key interlocks, control power transformer, pentahead bolts, and custom controls. All Pad Mounted Capacitor Assemblies are designed and built in accordance with applicable ANSI, NEMA, and IEEE standards.

- **Compact Design**
- **Economical**
- **Rugged Construction**
- **Tamper Resistant**
- **Available Through 2400 kVAR**

ASC Industries Inc.

DATE REC'D.: 2/18/93
TIME REC'D: 8:40am
PROJECT NO.:
ORIGINAL: RCL
COPY: TMR

LGE ELECTRICAL SALES, INC.

FACSIMILE

Receiving Location: Keller & Gannon
Facsimile Number:
Attention: Dick Lenwick
From: Doug Condon
Number of Pages in This Transmission: 1 Date: 2/18/93
Subject: ABB Pad Mounted Capacitor Banks

Based on our previous phone conversations, a budget price for a 1200 KVAR outdoor Pad mounted Cap. Bank would be $23,000.

This includes an incoming line section and a capacitor section with capacitor switching.

Approx. dimensions are 90" H x 120" W x 60" Deep. Width may be decreased depending on incoming line requirements.

I am sending you descriptive literature under a separate cover. Sorry this took so long.

Please call if you have any questions.

Doug Condon

1330 S. Bascom Ave., Ste. F • San Jose, CA 95128 • (408) 293-0755 • Fax (408) 293-0419